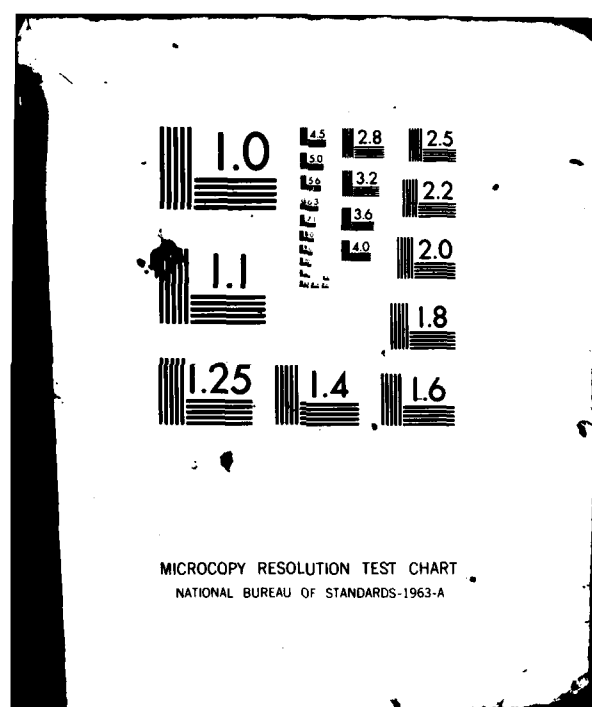


AD-A116 151 AIR FORCE AEROSPACE MEDICAL RESEARCH LAB WRIGHT-PATT--ETC F/G 1/2
USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK, VOLUME 165, MC-1 HEA--ETC(11)
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UNCLASSIFIED AMRL-TR-75-50-VOL-165 NL

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The MC-1 heater is a gasoline-motor driven, portable ground heater used primarily for cockpit and cabin temperature control. This report provides measured and extrapolated data defining the bioacoustic environments produced by this unit operating outdoors on a concrete apron at normal rated conditions. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise levels, and limiting times for total daily exposure of personnel.			

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with and without standard Air Force ear protectors. Far-field data measured at 36 locations are normalized to standard meteorological conditions and extrapolated from 10 - 1600 meters to derive sets of equal-value contours for these same seven acoustic measures as functions of angle and distance from the source. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application," AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc.

PREFACE

This report was prepared by the Biodynamic Environment Branch, Air Force Aerospace Medical Research Laboratory, under Project/Task 723107, Measurement and Prediction of Noise Environments of Air Force Operations.

The author gratefully acknowledges Mr. John N. Cole for his assistance in preparing this report, Mr. Robert G. Powell for his assistance in acquiring the raw data, Mr. Henry T. Mohlman and Mr. Fred D. Lampley of the University of Dayton for their assistance in the mechanics of data processing, and Mrs. Norma J. Peachey who typed and prepared the graphics.



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INTRODUCTION

The MC-1 heater is a gasoline-motor-driven, portable ground heater used primarily for cockpit and cabin temperature control. This unit is manufactured by the American Air Filter Company, Inc.

This volume provides measured and extrapolated data defining bioacoustic environments produced by this unit. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the MC-1.

This volume is one of a series published by the Air Force Aerospace Medical Research Laboratory (AFAMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and ground support equipment. The far-field, community-type, noise data in the handbook describe the noise produced during ground operations of aircraft, ground support equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Refer to Volume 1 (reference 1) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., inflight/flight crew and passenger noise, near-field ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published and is available upon request from AFAMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of each updated index as it is generated.

Direct any questions concerning the technical data in this report and other handbook volumes to: AFAMRL/BBE, Wright-Patterson AFB, OH 45433; AUTOVON 78-53675 or 78-53664; Commercial (513) 255-3675 or (513) 255-3664.

1. Cole, John N., USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application, AMRL-TR-75-50(1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.

NEAR-FIELD NOISE

MEASUREMENT

A standard MC-1 heater was operated outdoors on a concrete apron at normal rated conditions. Table 1 notes the surface meteorological conditions at the time of measurement.

Figure 1 identifies 72 noise measurement locations at a height of 1.5 meters above the concrete apron (nominal ear level of ground crew). The 0 degree reference direction passes through the tow bar. The 36 locations on the two inner circles are in the acoustic near-field of the source where the sound wave fronts generally do not spherically diverge and the source appears to be spatially distributed (i.e., not a point source). Consequently, these near-field data cannot be extrapolated to longer distances but do properly define the levels at locations close to the unit.

Near-field measurements were also made at ear level at the operator control panel. Table 1 lists the numeric/alphabetic designator used on the data pages in this report to identify the operator measurement location and test condition. The designator 1/A means operator location 1 and test condition A. Such a descriptor is essential in many handbook volumes that involve multiple combinations of locations/conditions. It is used in this report to maintain format consistency.

RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced by the MC-1 unit at the 37 specified, near-field locations. This table includes the overall, 1/3 octave band, and octave band levels. From these data one can calculate the variety of measures in Table 3 which are widely used to assess the effects of noise on personnel and their performance.

For data at other intermediate near-field locations (i.e., for radial distance less than 10 meters) you can interpolate between the 72 measured data points. All near-field data are for the meteorological conditions at the time of test but are valid for all typical airbase meteorology because of the short distances over which the sound is propagated.

TABLE 1

MEASUREMENT LOCATIONS AND TEST CONDITIONS FOR OPERATOR NOISE MEASUREMENTS

MC-1 Heater, Duct Type, Portable
Tyndall AFB, 19 June 1980
NSN 4520-01-012-2044, Field # F107

Measurement Location	
1	Operator Control Panel
Operation	
A	3400 RPM
Meteorology	
Temperature	29 °C
Bar Pressure	.761 M Hg
Rel Humidity	69 %
Wind - Speed	3.1 M/Sec (6 Kts)

FAR-FIELD NOISE

MEASUREMENTS

Noise measurements were also made on the same MC-1 unit under the same test conditions at the outer circle locations on Figure 1. These 36 locations are in the acoustic far-field of the source where the sound wave fronts spherically diverge and the unit may be regarded as a point noise source. Under these far-field conditions, the measured data can be extrapolated to longer distances.

RESULTS

Table 4 lists the overall and 1/3 octave band SPL measured at the 36 far-field locations under the meteorological conditions at the time of test. These data were normalized to 10 meters distance and standard meteorological conditions (15C temperature, 70% rel humidity, 0.760 meter Hg barometric pressure) and used to derive the graphic data in Figure 2 which provides a compact summary of the far-field noise characteristics of the MC-1 heater in a standard format.

These measured data were also used to derive sets of equal noise contours (Figures 3 through 9) describing seven different measures of noise as functions of angle and distance from the source for standard day meteorology. Note that Figure 8 contours identify limiting exposure times for personnel. Missing data points on any of the contours are the result of eliminating measured data which contained excessive influence of spurious background noise present at the time of measurement. In some cases contour levels at these missing data points were estimated and indicated with dashed lines.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)												
1/3 OCTAVE BAND												
2												
NOISE SOURCE/SUBJECT: (OPERATION:)												
MC-1 HEATER, DUCT TYPE, (3400 RPM)												
PORTABLE ()												
NEAR FIELD NOISE LEVELS ()												
IDENTIFICATION:)												
) OMEGA 3.2												
) TEST BA-000-002												
) RUN 01												
) 25 JAN 82												
) PAGE F1												
LOCATION/CONDITION												
FREQ	DISTANCE (M)-->	4	4	4	4	4	4	4	4	4	4	4
(HZ)	ANGLE (DEG)-->	0	20	40	60	80	100	120	140	160	180	200
	CONDITION-->	A	A	A	A	A	A	A	A	A	A	A
25												
31.5		77<	77<	77<	76<	75<			78<	77<	78<	75<
40												77<
50		85	85	84	83	81<	80<	79<	79<	79<	75<	79<
63		84	84	83	82<	81<	80<	79<	79<	93	79<	81<
80		74<	73<	72<	72<	73<	73<	72<				82<
100		71<	68<	71<	74	76	75	73	76	75	72	72<
125		73	74	76	78	78	76	75	78	77	75	76
160		75	75	78	79	80	80	80	79	92	82	79
200		71	70	70	72	72	70	71	71	72	72	71
250		75	75	73	71	72	71	72	74	75	75	74
315		80	79	76	71	68	70	73	75	76	76	75
400		90	79	76	73	75	77	72	78	75	73	74
500		78	76	76	71	72	70	72	73	72	75	72
630		77	76	74	71	71	74	71	74	71	72	71
800		74	73	73	71	68	68	68	68	68	69	67
1000		77	73	74	70	67	66	66	70	68	65	66
1250		74	73	73	70	68	68	66	67	67	65	65
1600		71	71	70	68	63	62	62	62	62	61	63
2000		71	71	68	65	62	60	60	61	61	60	62
2500		72	71	70	67	65	62	62	63	61	60	61
3150		73	72	70	67	62	60	61	61	60	60	61
4000		70	70	68	65	59	57	57	57	57	56	57
5000		68	68	67	63	56	55	55	55	56	54	56
6300		67	65	64	62	56	53	53	54	54	52	55
8000		66	67	64	63	55	55	54	55	54	54	55
10000		63	62	62	60	51	51	51	51	50	49	52
OVERALL		91	90	89	89	88	87	86	88	88	86	88

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE 1 MEASURED SOUND PRESSURE LEVEL (DB)													IDENTIFICATION:
2 1/3 OCTAVE BAND													OMEGA 3.2
NOISE SOURCE/SUBJECT: (OPERATION:)													TEST BA-000-002
MC-1 HEATER, DUCT TYPE, (3400 RPM)													RUN 02
PORTABLE ()													25 JAN 82
NEAR FIELD NOISE LEVELS ()													PAGE F2
LOCATION/CONDITION													
FREQ	DISTANCE (M)-->	4	4	4	4	2	2	2	2	2	2	2	
(HZ)	ANGLE (DEG)-->	260	280	300	320	340	0	20	40	60	80	100	120 140
	CONDITION----	A	A	A	A	A	A	A	A	A	A	A	A
25													
31.5		77<	77<	75<	79<	75<	60<	79<	78<	77<	70<	77<	76< 77<
40													
50		83	83	84	83	83	87	87	86	85	84	82	83 81<
63		82<	83	83	83	83	87	86	85	84	83	83	82< 81<
80		73<	75<	75<	75<	73<	74<	76<	75<	74<	71<	70<	
100		74	72<	72<	72<	73<	73	74	75	74	74	72	73 73
125		76	76	77	75	72<	77	78	76	76	76	75	77 78
160		76	75	80	82	80	81	79	80	81	79	76	79 85
200		70	70	70	72	73	82	82	81	78	75	72	71 75
250		73	74	74	75	75	85	83	81	79	78	77	73 75
315		75	74	74	76	79	85	82	82	80	77	78	74 73
400		73	74	75	77	80	82	83	83	77	79	79	81 80
500		73	74	73	77	81	83	83	81	75	75	76	75 80
630		75	73	74	73	76	83	83	78	73	75	74	74 74
800		67	68	69	71	72	79	80	77	72	72	71	70 72
1000		69	72	71	74	75	82	80	77	73	72	71	72 71
1250		68	69	72	73	73	80	79	78	73	71	71	70 70
1600		63	65	64	72	72	78	77	76	69	66	66	67 66
2000		63	66	68	71	73	79	75	73	69	66	65	65 64
2500		63	66	69	72	74	79	77	74	71	67	67	66 65
3150		63	65	67	70	74	78	76	74	69	65	65	65 65
4000		59	61	65	67	70	75	74	72	66	62	61	61 61
5000		58	59	64	66	68	74	72	70	64	61	60	61 60
6300		55	58	63	65	68	71	71	69	51	59	58	58 58
8000		57	59	63	65	67	70	70	69	62	59	58	58 59
10000		53	54	60	63	63	65	65	65	59	56	56	55 56
OVERALL		80	89	89	90	91	95	94	93	81	90	89	89 90

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)											IDENTIFICATION:
2 1/3 OCTAVE BAND											OMEGA 3.2
NOISE SOURCE/SUBJECT: MC-1 HEATER, DUCT TYPE, PORTABLE											TEST BA-000-002
OPERATION: 3400 RPM											RUN 03
NEAR FIELD NOISE LEVELS											25 JAN 82
											PAGE F3
LOCATION/CONDITION											OPERATOR LOCATION
FREQ (HZ)	DISTANCE (M)-->	2	2	2	2	2	2	2	2	2	TEST CONDITION
	ANGLE (DEG)-->	160	180	200	220	240	260	280	300	320	1/A
	CONDITION----	A	A	A	A	A	A	A	A	A	
25											
31.5		75<		76<	75<	74<	76<				
40											
50		83	83	84	82	83	84	84	85	85	89
63		81<	82<	83	82<	83	84	84	85	85	89
80		73<	72<	73<			72<	75<	75<	74<	77<
100		74	77	76	73	74	74	74	71<	69<	80
125		78	79	78	76	77	77	76	75	71<	87
160		80	88	87	85	85	83	76	80	82	92
200		80	81	80	77	76	74	73	74	78	82
250		79	81	80	77	74	75	76	76	81	88
315		76	73	76	73	75	77	79	77	79	89
400		80	81	85	83	79	79	78	77	79	83
500		79	78	83	80	77	76	76	75	77	85
630		75	75	76	77	73	76	75	74	77	83
800		73	73	74	72	71	71	72	72	75	77
1000		72	71	72	74	72	74	72	75	81	74
1250		71	71	71	73	74	74	73	74	78	77
1600		65	66	67	68	67	67	69	71	76	71
2000		65	64	65	65	65	65	67	70	74	70
2500		65	65	66	66	66	68	68	71	76	69
3150		65	65	66	66	66	66	67	71	76	67
4000		61	62	62	65	65	66	67	71	74	67
5000		61	60	61	61	62	63	63	67	71	64
6300		59	57	59	60	60	60	64	69	71	62
8000		59	58	59	61	61	60	60	65	70	63
10000		55	55	56	59	56	57	57	61	65	60
OVERALL		82	92	93	81	90	81	90	90	82	98

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)													IDENTIFICATION:
2 OCTAVE BAND													
NOISE SOURCE/SUBJECT: (OPERATION:)													OMEGA 3.2
MC-1 HEATER, DUCT TYPE, (3400 RPM)													TEST 9A-000-002
PORTABLE ()													RUN 01
NEAR FIELD NOISE LEVELS ()													25 JAN 82
()													PAGE J1
LOCATION/CONDITION													
FREQ	DISTANCE (M)-->	+	+	+	+	+	+	+	+	+	+	+	+
(HZ)	ANGLE (DEG)-->	0	20	40	60	80	100	120	140	160	180	200	240
	CONDITION-->>	A	A	A	A	A	A	A	A	A	A	A	A
31.5		87	87	86	86	85	84	82	82	84	81	82	84
63		78	78	81	82	83	82	82	83	84	83	81	82
125		82	81	74	76	76	75	77	78	79	79	78	77
250		83	82	80	77	75	79	76	80	78	79	77	80
500		80	78	78	75	72	72	71	73	72	71	71	73
1000		75	76	74	71	69	66	66	67	66	65	66	68
2000		75	75	73	70	69	62	63	63	53	62	63	65
4000		70	70	68	66	59	58	59	58	59	57	59	61
8000													60
OVERALL		81	80	89	88	88	87	85	87	88	87	86	88

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)										IDENTIFICATION:	
OCTAVE BAND											
2										OMEGA 3.2	
										TEST BA-000-002	
NOISE SOURCE/SUBJECT:		OPERATION:								PUN 02	
MC-1 HEATER, DUCT TYPE,		3400 RPM								25 JAN 82	
PORTABLE											
NEAR FIELD NOISE LEVELS										PAGE J2	
LOCATION/CONDITION											
FREQ	DISTANCE (M)-->	4	4	4	4	2	2	2	2	2	2
(HZ)	ANGLE (DEG)-->	260	280	300	320	340	0	20	40	60	80
	CONDITION-->	A	A	A	A	A	A	A	A	A	A
31.5											
63		85	86	87	86	86	90	89	88	86	85
125		80	80	82	83	81	83	82	83	81	79
250		78	78	78	79	81	89	87	86	84	81
500		78	78	78	81	84	87	88	86	80	81
1000		73	75	76	78	78	85	84	82	77	76
2000		68	70	73	76	78	83	81	79	74	71
4000		62	67	70	73	75	81	79	77	71	68
8000		60	62	67	70	71	74	74	73	66	63
OVERALL		88	88	89	90	91	95	94	93	91	90

TABLE 1 MEASURED SOUND PRESSURE LEVEL (D3)											IDENTIFICATION#
2 OCTAVE BAND											
NOISE SOURCE/SUBJECT: (OPERATION#)											
MC-1 HEATER, JUCT TYPE, (3400 RPM)											OMEGA 3.2
PORTABLE ()											TEST 9A-003-002
NEAR FIELD NOISE LEVELS ()											RUN 03
()											25 JAN 82
()											PAGE J3
LOCATION/CONDITION											OPERATOR LOCATION
FREQ	DISTANCE (M)-->	2	2	2	2	2	2	2	2	2	TEST CONDITION
(HZ)	ANGLE (DEG)-->	160	180	200	220	240	260	280	300	320	1/A
	CONDITION----	A	A	A	A	A	A	A	A	A	
31.5											
63		45	86	87	85	86	87	87	88	88	92
125		89	89	89	86	86	84	81	81	82	93
250		93	89	84	81	80	80	81	81	94	92
500		83	83	87	85	81	82	81	90	92	88
1000		77	76	77	76	77	78	77	78	83	81
2000		70	69	71	71	71	72	73	75	80	75
4000		67	67	68	69	69	70	70	75	79	71
8000		63	62	63	64	64	64	64	69	73	66
OVERALL		92	92	93	91	90	90	90	90	92	98

TABLE: MEASURES OF HUMAN NOISE EXPOSURE													IDENTIFICATION:
3													OMEGA 3.2
NOISE SOURCE/SUBJECT: (OPERATION:)													TEST 9A-000-002
MC-1 HEATER, DUCT TYPE, (3400 RPM)													RUN 01
PORTABLE ()													25 JAN 82
NEAR FIELD NOISE LEVELS ()													PAGE M1
LOCATION/CONDITION													
DISTANCE (M)-->	4	4	4	4	4	4	4	4	4	4	4	4	
ANGLE (DEG)-->	0	20	40	60	80	100	120	140	160	180	200	220	240
CONDITION-->>	A	A	A	A	A	A	A	A	A	A	A	A	A
HAZARD/PROTECTION													
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR													
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR													
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)													
NO PROTECTION													
OASLC	90	89	89	88	87	87	86	87	98	87	86	87	88
OASLA	85	84	83	80	73	78	77	80	79	79	78	80	79
T	404	403	571	900	960	960	960	960	960	960	960	960	960
MINIMUM QPL EAR MUFFS													
OASLA*	65	64	64	64	64	64	63	64	65	64	62	64	64
T	960	960	960	960	960	960	960	960	960	960	960	960	960
AMERICAN OPTICAL 1700 EAR MUFFS													
OASLA*	62	61	61	60	60	59	59	59	61	59	58	60	60
T	960	960	960	960	960	960	960	960	960	960	960	960	960
V-51R EAR PLUGS													
OASLA*	62	60	59	56	55	56	55	57	57	57	56	57	57
T	960	960	960	960	960	960	960	960	960	960	960	960	960
AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS													
OASLA*	48	46	46	44	43	43	42	43	44	43	42	43	44
T	960	960	960	960	960	960	960	960	960	960	960	960	960
H-133 GROUND COMMUNICATION UNIT													
OASLA*	59	57	57	55	54	53	53	54	55	53	52	54	55
T	960	960	960	960	960	960	960	960	960	960	960	960	960
COMMUNICATION													
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)													
PSIL	80	78	77	74	73	72	71	73	72	72	71	74	73
ANNOYANCE													
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)													
TONE CORRECTION (C IN DB)													
PNLT	130	98	98	95	93	94	92	94	93	93	92	94	93
C	1	1	1	1	1	2	1	1	1	1	1	1	1

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

TABLE: MEASURES OF HUMAN NOISE EXPOSURE											IDENTIFICATION#
3											OMEGA 3.2
NOISE SOURCE/SUBJECT: (OPERATION:)											TEST 9A-000-002
MC-1 HEATER, DUCT TYPE, (3400 RPM)											RUN 03
PORTABLE ()											25 JAN 82
NEAR FIELD NOISE LEVELS ()											PAGE 11
LOCATION/CONDITION											OPERATOR LOCATION
DISTANCE (M)-->	2	2	2	2	2	2	2	2	2	2	TEST CONDITION
ANGLE (DEG)-->	160	180	200	220	240	260	280	300	320	340	1/A
CONDITION-->	A	A	A	A	A	A	A	A	A	A	
HAZARD/PROTECTION											
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DBC) AT EAR											
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DBA) AT EAR											
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)											
NO PROTECTION											
OASLC	92	92	93	91	90	90	90	90	92	94	97
OASLA	83	84	85	84	82	83	83	84	88	90	89
T	571	490	404	480	673	571	571	480	240	173	202
MINIMUM SPL EAR MUFFS											
OASLA*	63	69	70	68	67	66	65	65	67	69	74
T	960	960	960	960	960	960	960	960	960	960	960
AMERICAN OPTICAL 1700 EAR MUFFS											
OASLA*	64	65	65	63	63	62	62	62	63	65	70
T	950	960	960	960	960	960	960	960	960	960	960
V-51R EAR PLUGS											
OASLA*	61	62	63	62	60	60	60	60	63	60	68
T	960	960	960	960	960	960	960	960	960	960	960
AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS											
OASLA*	48	48	49	47	46	47	46	46	50	51	53
T	950	960	960	960	960	960	960	960	960	960	960
H-133 GROUND COMMUNICATION UNIT											
OASLA*	55	59	59	57	57	57	57	58	61	63	64
T	960	960	960	960	960	960	960	960	960	960	960
COMMUNICATION											
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)											
PSIL	77	76	73	78	76	77	77	76	42	85	81
ANNOYANCE											
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNOB)											
TONE CORRECTION (C IN DB)											
PNLT	99	99	100	98	97	97	96	99	113	105	104
C	2	1	1	1	1	1	1	1	2	1	1

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)																			IDENTIFICATION:
4 1/3 OCTAVE BAND																			OMEGA 1.4
DISTANCE = 10 METERS																			TEST BA-000-002
NOISE SOURCE/SUBJECT:																			RUN 01
MC-1 HEATER, DUCT TYPE,																			TEMP = 29 C
PORTABLE																			BAR PRESS = .761 M HG
FAR FIELD NOISE LEVELS																			25 JAN 82
																			PAGE 2
FREQ (HZ)																			ANGLE (DEGREES)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180																			
25																			
31.5																			
40																			
50																			77< 76< 75< 75< 76< 75< 74< 74< 74< 74< 73< 73< 72< 71<
63																			77< 77< 76< 75< 76< 75< 75< 74< 75< 75< 73< 74< 73< 73<
80																			72<
100																			66< 67< 70< 69< 70< 70< 72< 73 73 72 72< 70< 66< 66< 70< 65< 65< 67< 67<
125																			72 70< 70< 71< 73 74 75 76 75 74 73 72 72< 73 72 72< 71< 71< 71<
160																			72 71 72 73 74 75 76 77 78 79 78 76 71 69< 71 74 75 76 75
200																			73 71 70 69 68 69 70 70 70 69 68 66 63 65< 65< 68 69 71 71
250																			69 70 70 69 69 69 69 71 70 69 69 70 71 68 69 70 71 71 71
315																			71 68 67 67 68 69 70 70 68 67 67 67 66 66 67 68 68 68
400																			70 68 67 65 64 64 62 64 65 66 65 68 64 67 65 67 66 67
500																			66 69 69 70 69 66 65 64 62 63 64 63 67 66 65 67 67 66
630																			70 68 67 65 65 64 65 64 63 63 65 64 64 65 65 63 62 63
800																			67 68 66 64 62 62 62 62 61 62 60 61 61 61 62 63 62 60
1000																			67 68 67 64 65 64 62 60 61 60 61 64 62 61 62 61 60 59
1250																			65 65 64 64 64 64 62 61 60 57 58 59 57 58 57 56 57 56
1600																			66 66 64 61 61 62 62 59 56 56 54 55 55 56 55 54 54 53
2000																			64 64 63 61 60 60 60 58 56 56 54 55 54 56 55 55 54 52
2500																			63 60 61 60 60 60 58 58 56 55 53 52 52 52 51 52 51 49
3150																			64 62 61 60 59 59 58 58 56 53 52 52 52 53 52 52 51 50
4000																			62 60 61 60 59 59 57 57 55 51 50 49 49 49 49 49 49 48
5000																			61 60 60 60 58 58 55 55 53 50 49 49 49 49 48 49 49 47
6300																			59 57 57 57 55 55 52 53 51 49 48 47 47 46 46 46 46
8000																			59 59 59 59 58 58 55 55 52 48< 49 49 49< 49< 48< 48< 46< 45<
10000																			55 54 54 54 54 53 50 50 47< 42< 43< 42< 42< 42< 41< 41< 41< 39<
OVERALL																			83 83 82 82 82 83 83 83 83 83 82 82 81 80 78 80 79 80

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

15

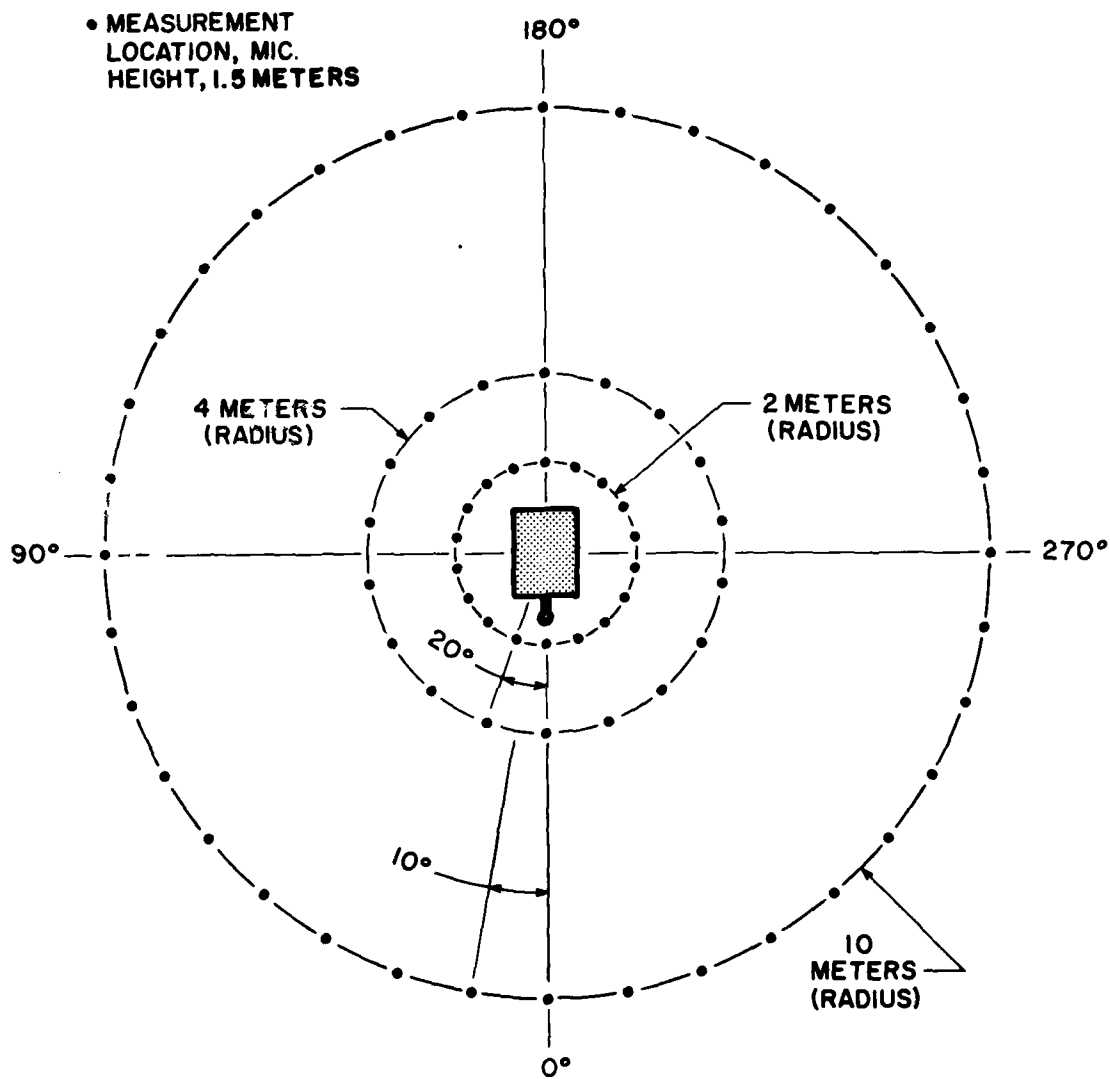


Figure 1. Measurement Locations

FIGURE 1 NORMALIZED FARFIELD NOISE LEVELS

2

DISTANCE = 10 METERS

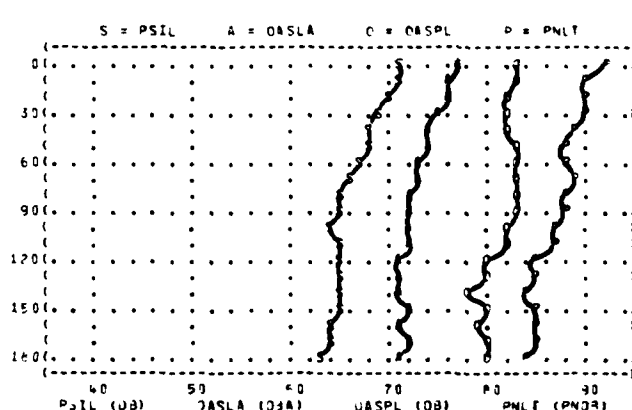
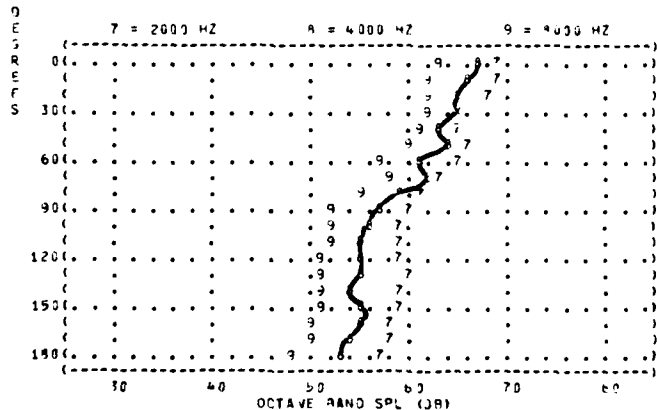
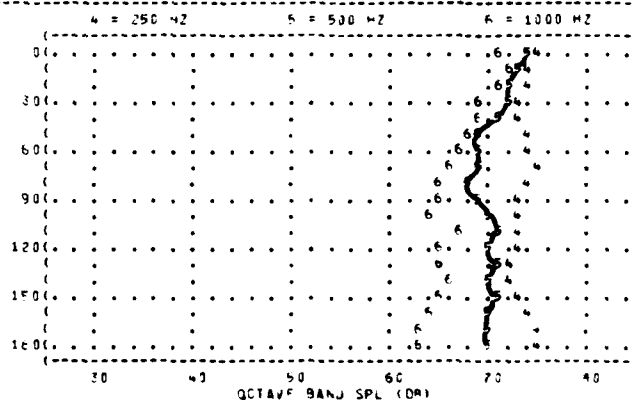
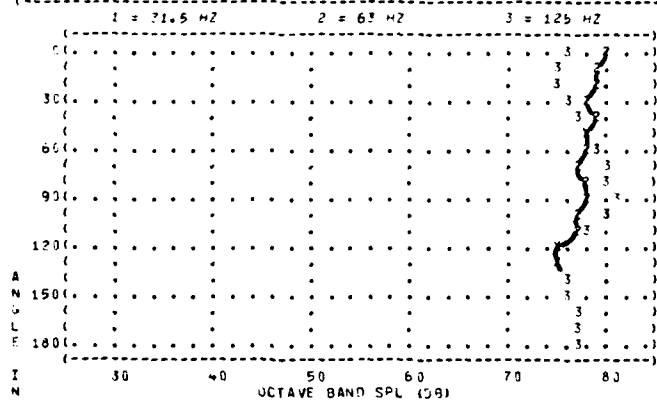
IDENTIFICATION

OMEGA 1.4
TEST RA-001-002
RUN 01
25 JAN 82
PAGE 4

NOISE SOURCE/SUBJECT:
HC-1 HEATER, DUCT TYPE,
PORTABLE
FAR FIELD NOISE LEVELS

OPERATION:
3400 RPM

METEOROLOGICAL:
TEMP = 15 C
BAR PRESS = 1060 MM HG
REL HUMID = 70 %



IDENTIFICATIONS

1 OMEGA 1.4

```
TEST 32-000-00
) RUN 32
)
) 25 JAN 82
)
) PAGE 4
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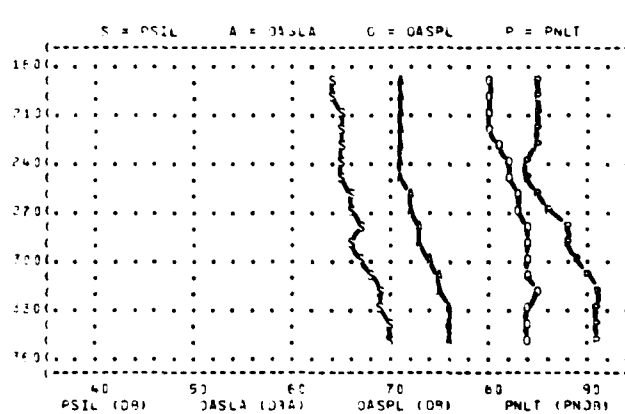
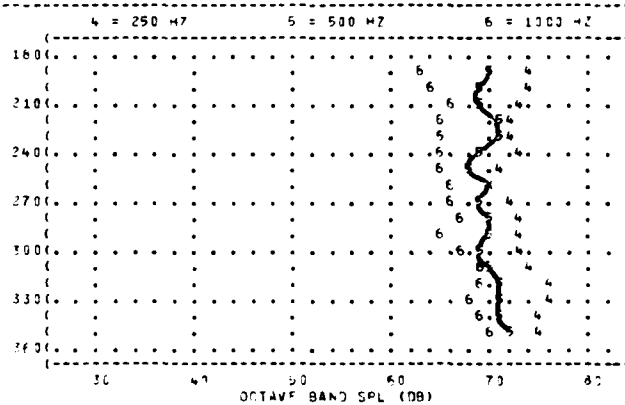


FIGURE: OVERALL SOUND PRESSURE LEVEL (OASPL)
EQUAL LEVEL CONTOURS (dB)

3

IDENTIFICATION:

OMEGA 1.4

TEST 9A-000-002

RUN 01

25 JAN 82

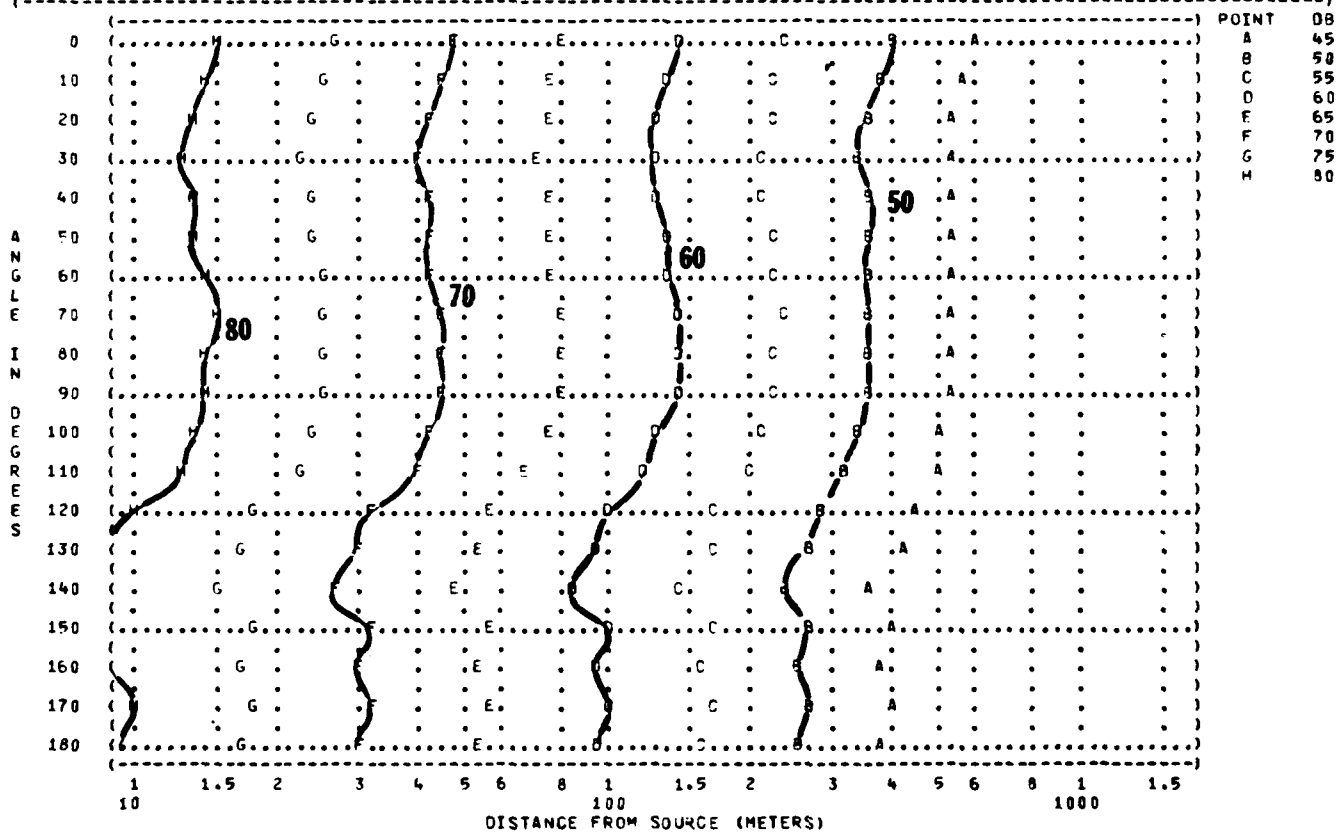
PAGE 11

NOISE SOURCE/SUBJECT:
MC-1 HEATER, JUCT TYPE,
PORTABLE
FAR FIELD NOISE LEVELS

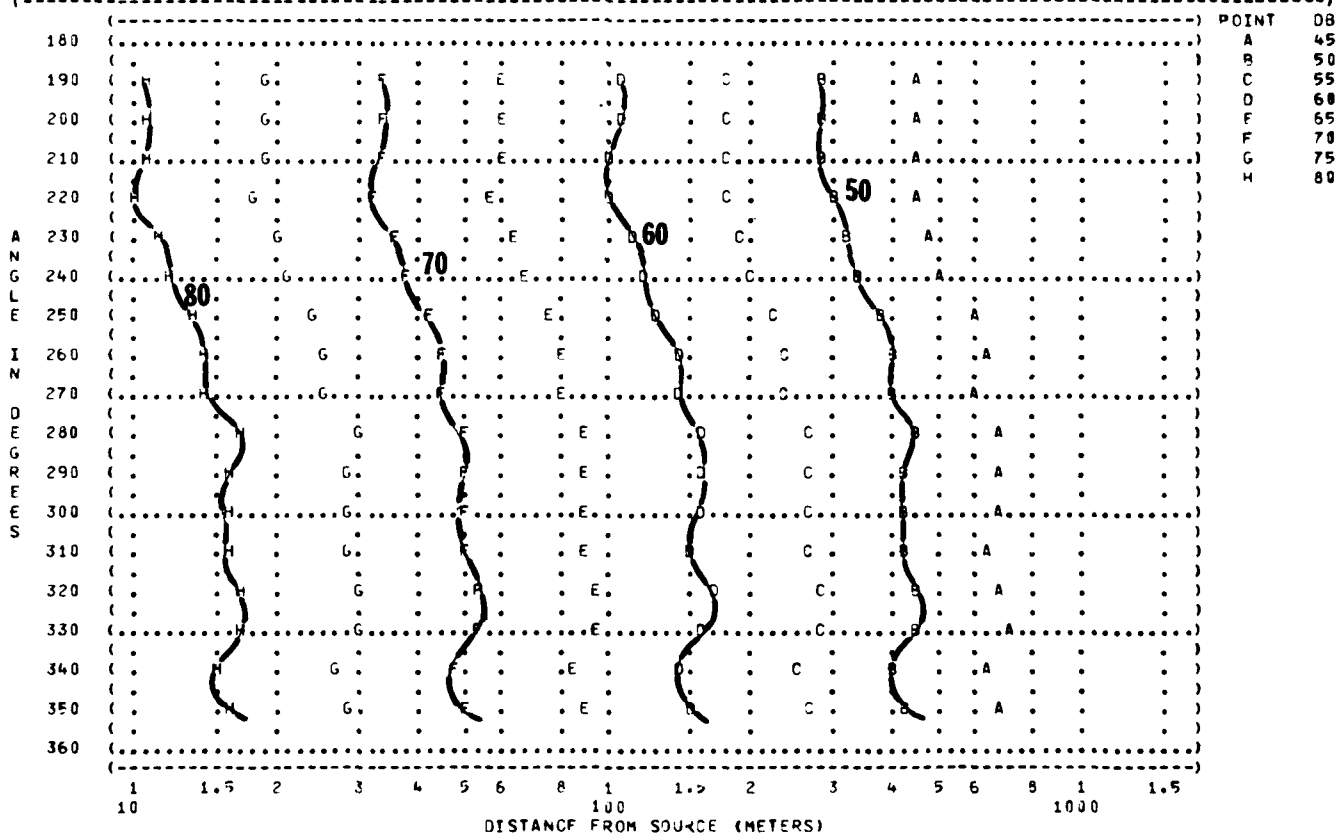
OPERATION:
3400 RPM

METEOROLOGY:

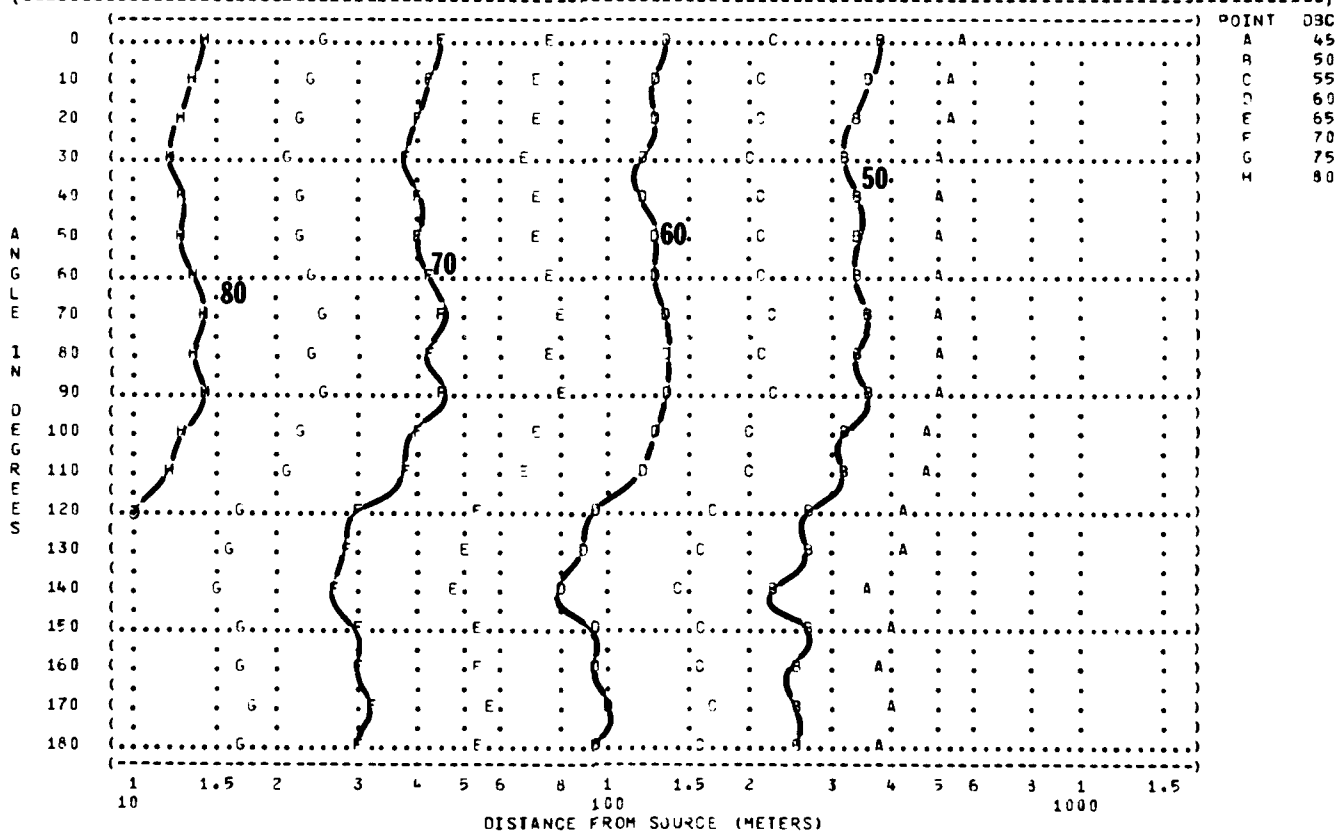
TEMP = 15 C
BAR PRESS = .760 M HG
REL HUMID = 70 %



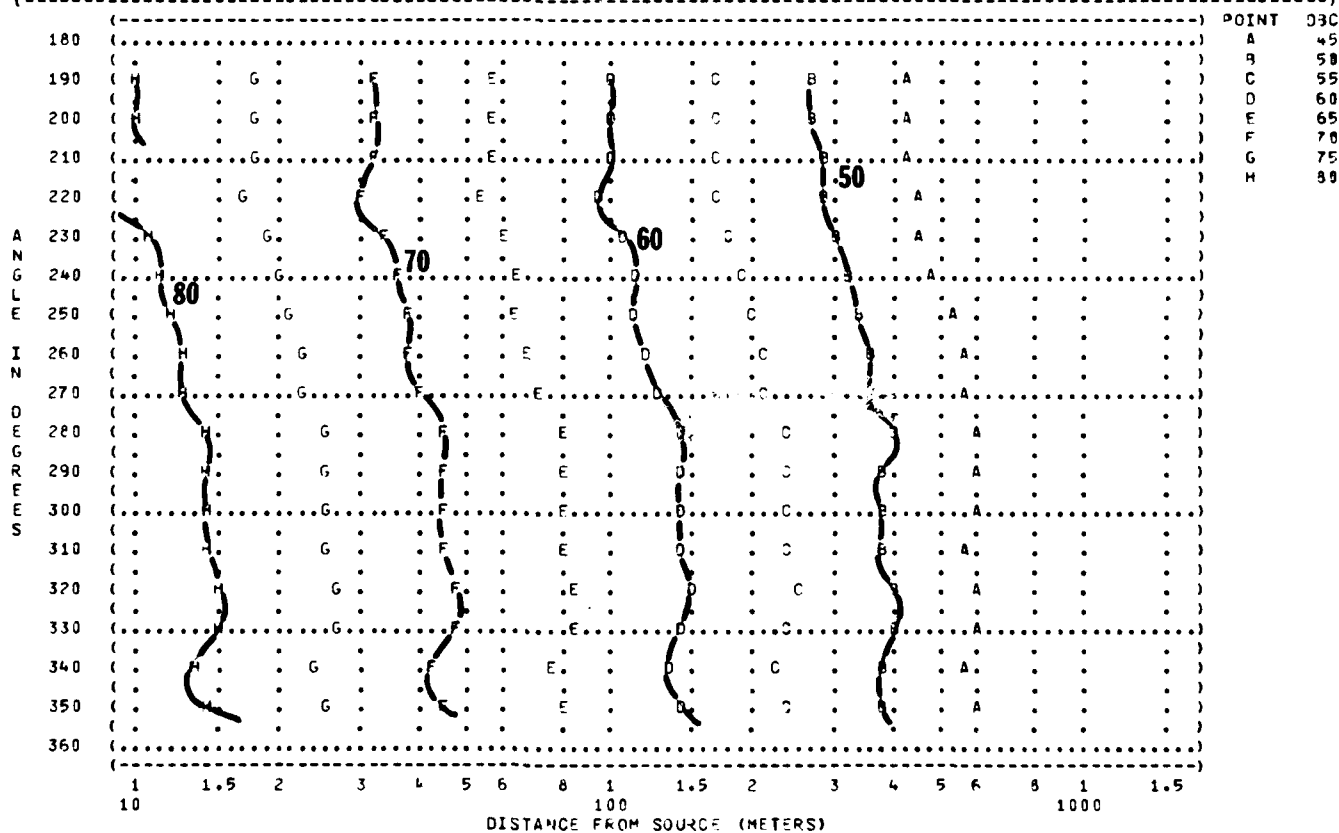
(FIGURE: OVERALL SOUND PRESSURE LEVEL (OASPL))
 (3 EQUAL LEVEL CONTOURS (DB))
 (IDENTIFICATION:)
 () OMEGA 1.4)
 (TEST BA-000-002)
 (NOISE SOURCE/SUBJECT: (OPERATIONS:) METEOROLOGY:)
 (MC-1 HEATER, DUCT TYPE, (3400 RPM) TEMP = 15 C)
 (PORTABLE () BAR PRESS = .760 M HG)
 (FAR FIELD NOISE LEVELS () REL HUMID = 70 %)
 () PAGE 11)



(FIGURE: C-WEIGHTED OVERALL SOUND LEVEL (OASLC))
 (4 EQUAL LEVEL CONTOURS (DNC))
 (IDENTIFICATION:)
 ()
 () OMEGA 1.4)
 () TEST RA-000-032)
 () RUN 01)
 () 25 JAN 82)
 () PAGE 12)
 (NOISE SOURCE/SUBJECT: (OPERATION:) METEOROLOGY:)
 (MC-1 HEATER, DUCT TYPE, (3400 RPM) TEMP = 15 C)
 (PORTABLE () BAR PRESS = .750 M HG)
 (FAP FIELD NOISE LEVELS () REL HUMID = 70 %)



(FIGURE: C-WEIGHTED OVERALL SOUND LEVEL (OASLC) (4 EQUAL LEVEL CONTOURS (ELC)) IDENTIFICATION:)) OMEGA 1.4)) TEST BA-900-002)) RUN 02)) 25 JAN 82)) PAGE 12)
(NOISE SOURCE/SUBJECT:) (MC-1 HEATER,DUCT TYPE,) (PORTABLE) (FAR FIELD NOISE LEVELS)	(OPERATIONS:) (3400 RPM)) METEOROLOGY:)) TEMP = 15 C)) BAR PRESS = .760 M HG)) REL HUMID = 70 %)	



(FIGURE: A-WEIGHTED OVERALL SOUND LEVEL (OASLA)			) IDENTIFICATION:)	
(5 EQUAL LEVEL CONTOURS (DBA)))	
( )			) OMEGA 1.4)	
( )			) TEST BA-000-002)	
(NOISE SOURCE/SUBJECT: (OPERATION:) METEOROLOGY: )			) RUN 01)	
(MC-1 HEATER, JUCT TYPE, (3400 RPM )			) TEMP = 15 C)	
(PORTABLE ( )			) BAR PRESS = .760 M HG)	
(FAR FIELD NOISE LEVELS ( )			) 25 JAN 82)	
( )			) REL HUMID = 70 %)	
( )			) PAGE 13)	

21

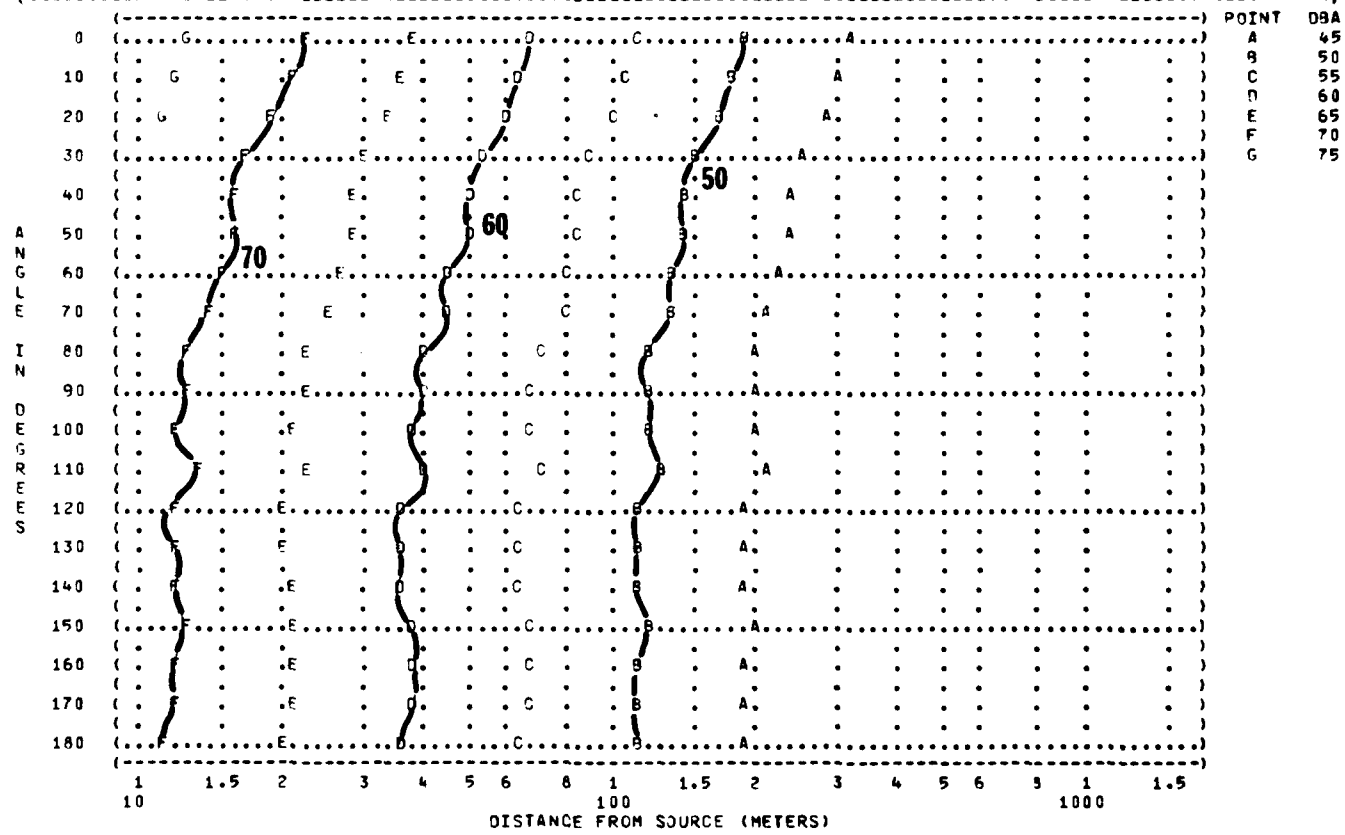
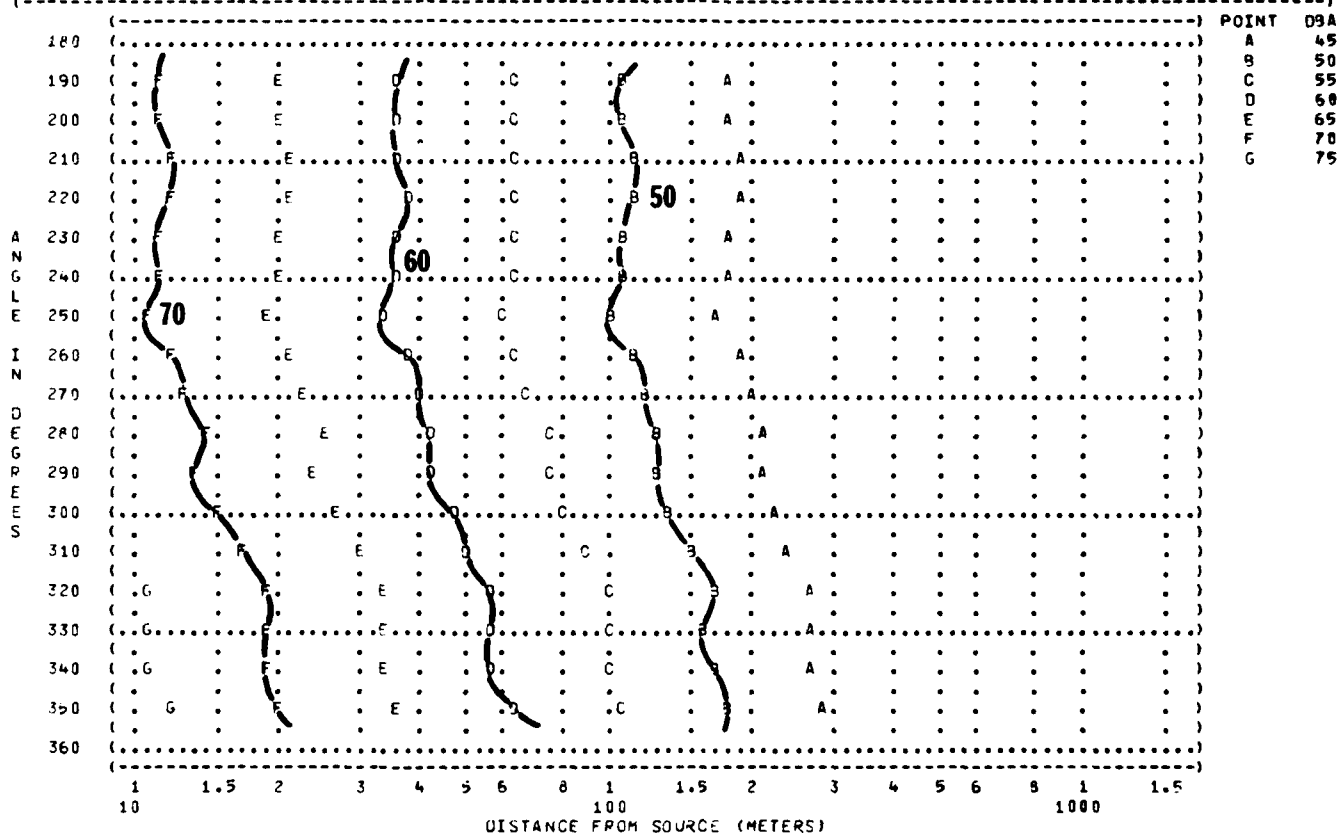


FIGURE 1 A-WEIGHTED OVERALL SOUND LEVEL (OASLA)
 5 EQUAL LEVEL CONTOURS (DBA)

IDENTIFICATION:
 OMEGA 1.4
 TEST BA-000-002
 RUN 02

NOISE SOURCE/SUBJECT: (OPERATION:) METEOROLOGY:
 MC-1 HEATER, JUCT TYPE, (3400 RPM) TEMP = 15 C
 PORTABLE () BAR PRESS = .760 MM HG
 FAR FIELD NOISE LEVELS () REL HUMID = 70 %

25 JAN 82
 PAGE 13



(FIGURE: PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT)) IDENTIFICATION:)
 (6 EQUAL LEVEL CONTOURS (PNDB)))
 (NOISE SOURCE/SUBJECT: (OPERATION:) METEOROLOGY:) TEST RA-030-002)
 (MC-1 HEATER, DUCT TYPE, (3400 RPM) TEMP = 15 C) RUN 01)
 (PORTABLE () BAR PRESS = .750 M HG) 25 JAN 82)
 (FAR FIELD NOISE LEVELS () REL HUMID = 70 %) PAGE 14)

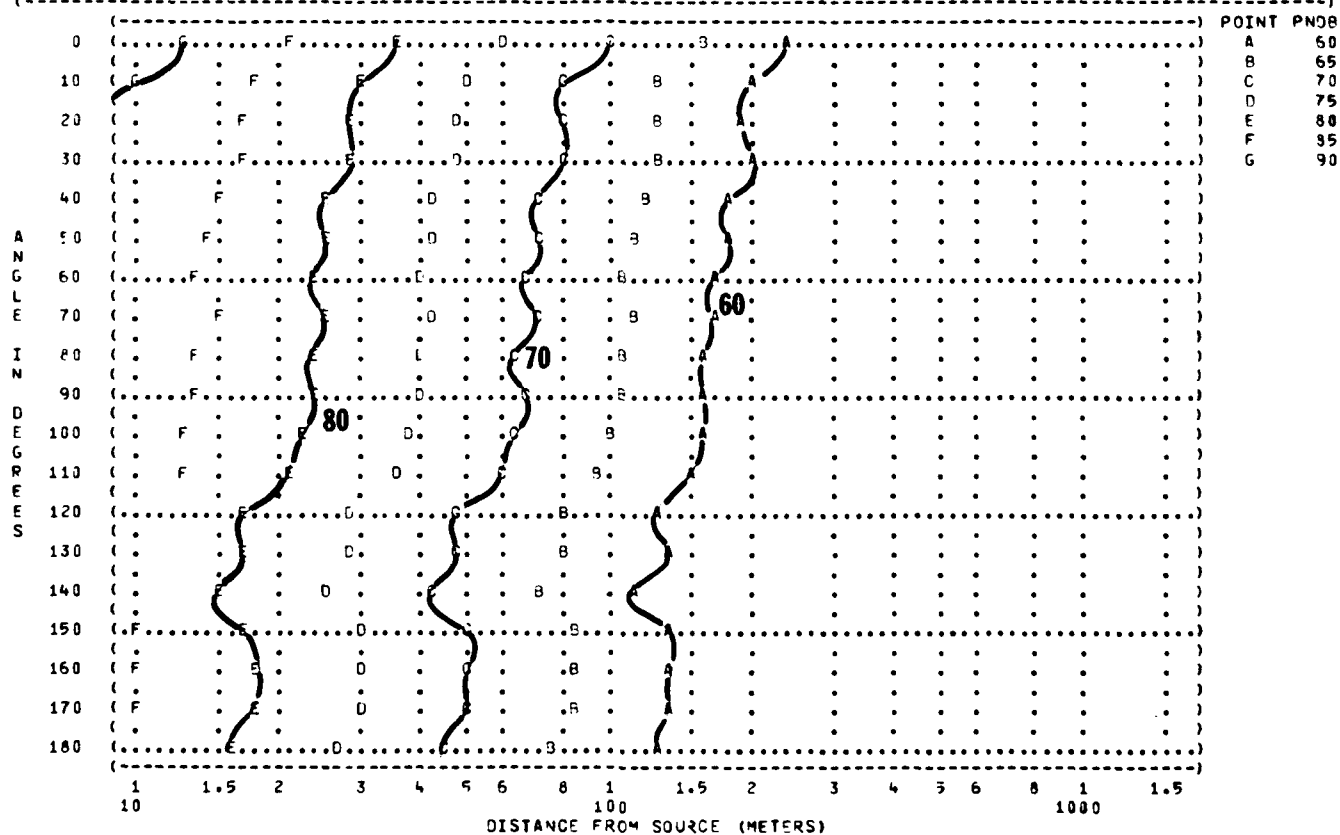


FIGURE: PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT)
 6 EQUAL LEVEL CONTOURS (PNDB)

IDENTIFICATION:
 OMEGA 1.4
 TEST BA-000-002
 RUN 02
 25 JAN 82
 PAGE 14

NOISE SOURCE/SUBJECT: (OPERATION:) METEOROLOGY:
 MC-1 HEATER, DUCT TYPE, (3400 RPM) TEMP = 15 C
 PORTABLE () BAR PRESS = .760 M HG
 FAR FIELD NOISE LEVELS () REL HUMID = 70 %

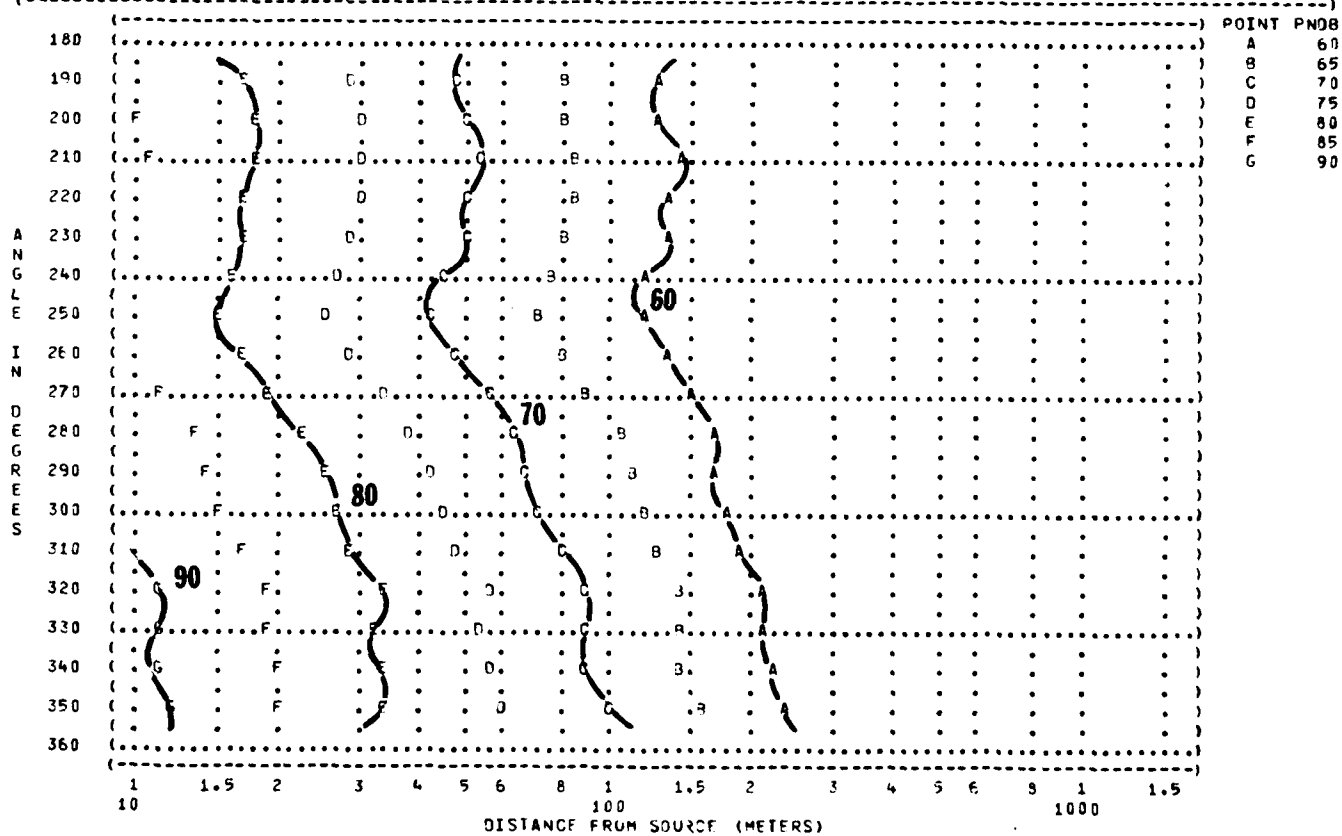


FIGURE 1 PREFERRED SPEECH INTERFERENCE LEVEL (PSIL)
EQUAL LEVEL CONTOURS (dB)

NOISE SOURCE/SUBJECT:
MC-1 HEATER, JET TYPE,
PORTABLE
FAR FIELD NOISE LEVELS

OPERATION:
3400 RPM

METEOROLOGY:
TEMP = 15 C
BAR PRESS = .760 M HG
REL HUMID = 70 %

IDENTIFICATION:
OMEGA 1.4
TEST RA-000-002
RUN 02
25 JAN 62
PAGE 15

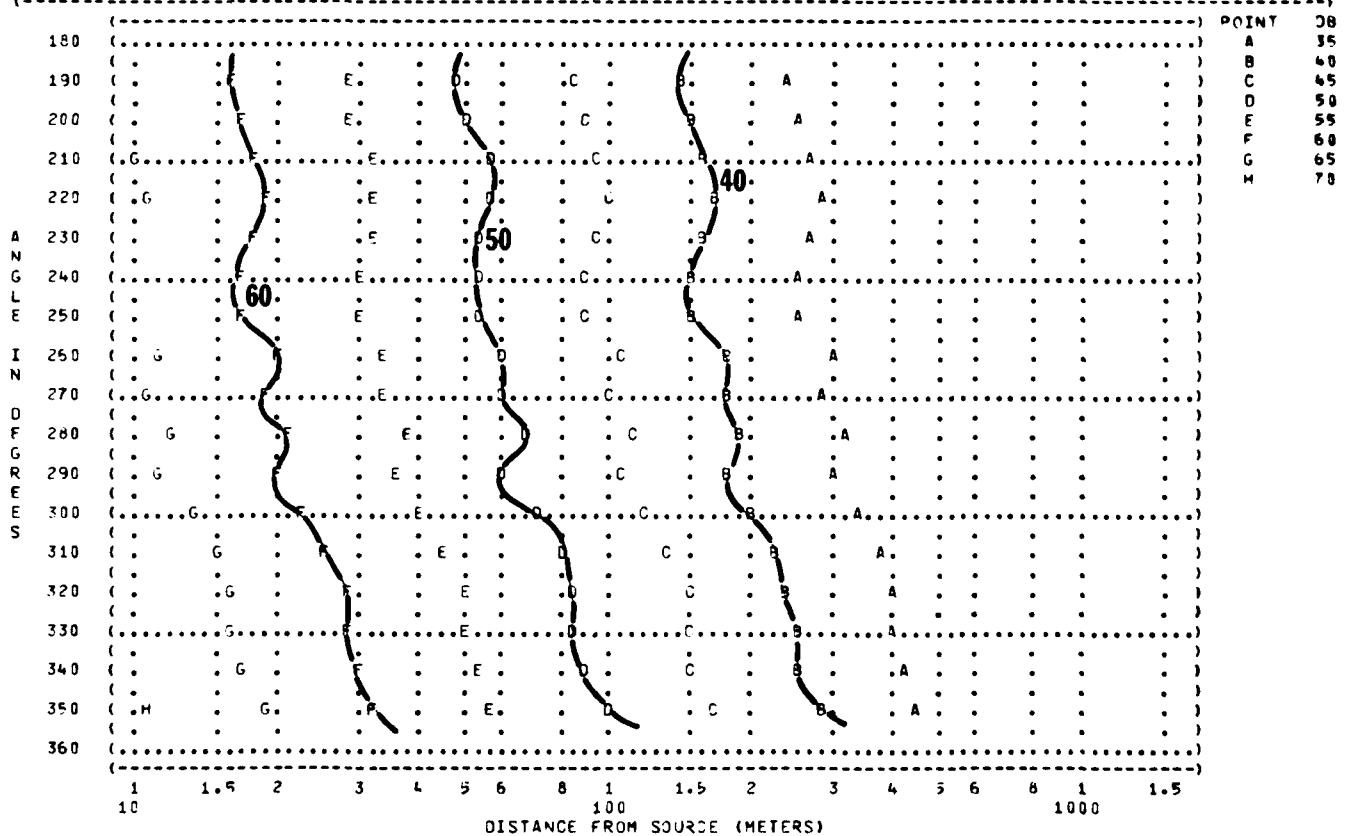
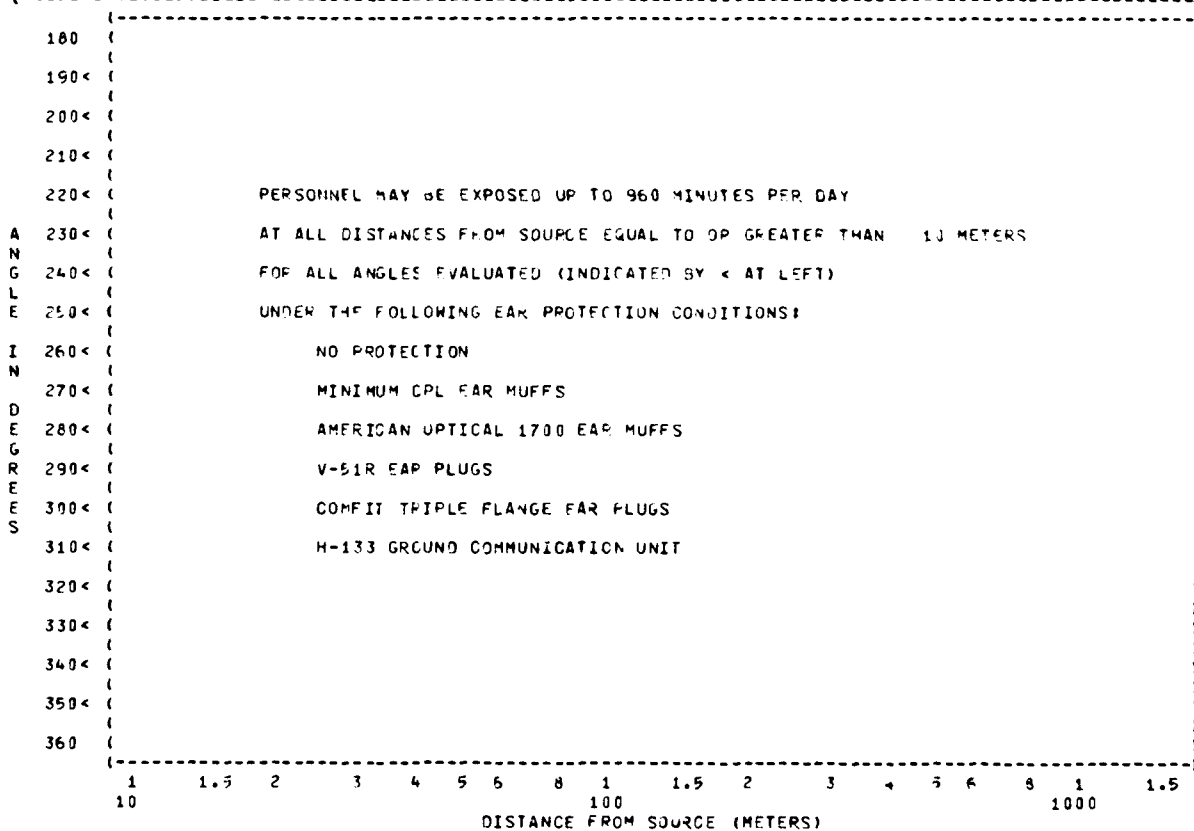


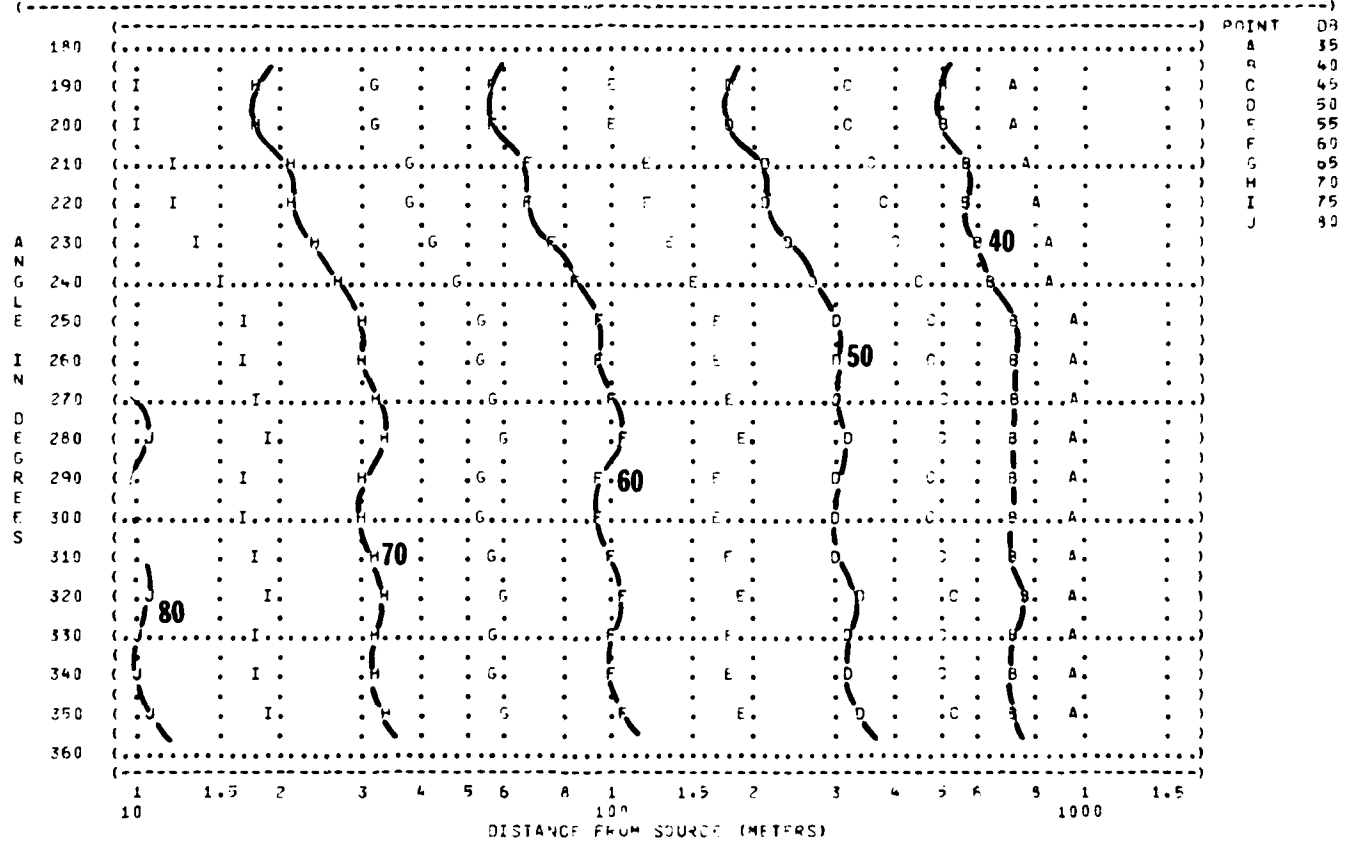
FIGURE 8 MAXIMUM PERMISSIBLE TIME (T) FOR ONE EXPOSURE PER DAY (AFR 101-35, JULY 73)			IDENTIFICATION:
EQUAL TIME CONTOURS (MINUTES)			
			OMEGA 1.4
			TEST RA-000-002
NOISE SOURCE/SUBJECT:	OPERATION:	METEOROLOGY:	RUN 02
MC-1 HEATER, DUCT TYPE,	3400 RPM	TEMP = 15 C	
PORTABLE		BAR PRESS = .760 M HG	25 JAN 82
FAR FIELD NOISE LEVELS		REL HUMID = 70 %	
			PAGE 5



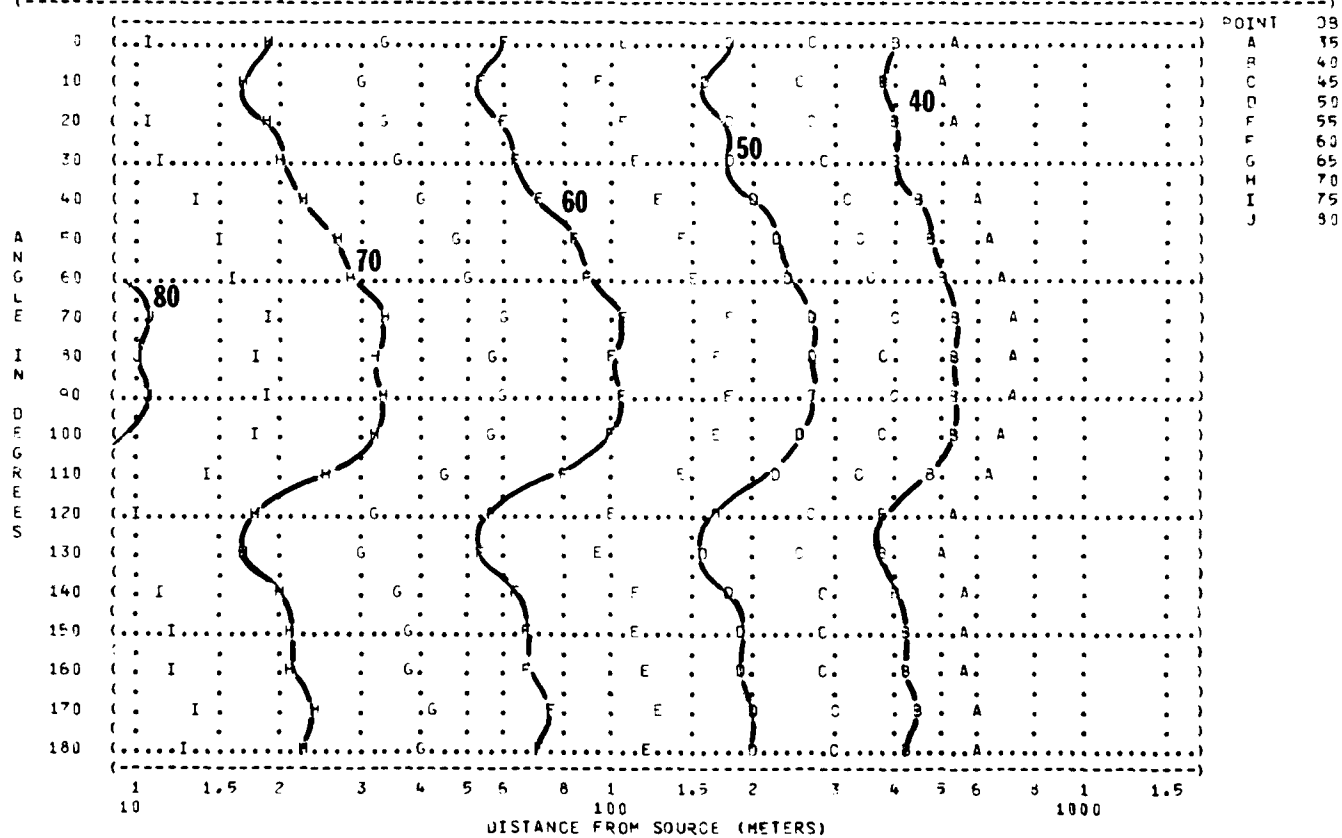
(FIGURE: SOUND PRESSURE LEVEL (SPL)) IDENTIFICATION:)
 (9 EQUAL LEVEL CONTOURS (dB)))
 (31.5 HZ OCTAVE BAND) OMEGA 1.4)
 (NOISE SOURCE/SUBJECT: (OPERATIONS:) METEOROLOGY:) TEST RA-000-002)
 (MC-1 HEATER, DUCT TYPE, (3400 RPM) TEMP = 15 C) RUN 02)
 (PORTABLE () BAR PRESS = .760 M H.) 25 JAN 62)
 (FAR FIELD NOISE LEVELS () REL HUMID = 70 %))
 () PAGE 16)
 ()
 (NO CONTOUR DATA---EITHER NO INPUT DATA WERE COMPUTED (=9999.0))
 (OR MINIMUM CONTOUR LEVEL REQUESTED IS GREATER THAN MAXIMUM COMPUTED LEVEL.)
 ()

(FIGURE: SOUND PRESSURE LEVEL (SPL)) IDENTIFICATION:)
 (9 EQUAL LEVEL CONTOURS (L3)))
 (31.5 HZ OCTAVE BAND))
 (NOISE SOURCE/SUBJECT: (OPERATION:) METEOROLOGY:)
 (MC-1 HEATER, DUCT TYPE, (3400 RPM) TEMP = 15 C)
 (PORTABLE () BAR PRESS = .760 M HG) 25 JAN 82)
 (FAR FIELD NOISE LEVELS () REL HUMID = 70 %)
 ())
 ()
 (NO CONTOUR DATA---EITHER NO INPUT DATA WERE COMPUTED (=9999.0))
 (OR MINIMUM CONTOUR LEVEL REQUESTED IS GREATER THAN MAXIMUM COMPUTED LEVEL.)
 ()
 ()

(FIGURE: SOUND PRESSURE LEVEL (SPL)			) IDENTIFICATION:	
(9 EQUAL LEVEL CONTOURS (DB))	
(63 HZ OCTAVE BAND			) OMEGA 1.4	
(NOISE SOURCE/SUBJECT:			) TEST BA 000-002	
(MC-1 HEATER, JUCT TYPE,			) RUN 02	
(PORTABLE			) 25 JAN 82	
(FAR FIELD NOISE LEVELS			) PAGE 17	
(OPERATION:)	
(3400 RPM)	
(METEOROLOGY:)	
(TEMP = 15 C)	
(BAR PRESS = .760 M HG)	
(REL HUMID = 70 %)	



(FIGURE: SOUND PRESSURE LEVEL (SPL)) IDENTIFICATION:)
 (9 EQUAL LEVEL CONTOURS (dB)))
 (125 HZ OCTAVE BAND))
 (NOISE SOURCE/SUBJECT:) OPERATION:) METEOROLOGY:)
 (MC-1 HEATER, JET TYPE,) 3400 RPM) TEMP = 15 C)
 (PORTABLE)) BAR PRESS = .760 M HG)
 (FAR FIELD NOISE LEVELS)) REL HUMID = 70 %)
 ()) 25 JAN 82)
 ()) PAGE 13)

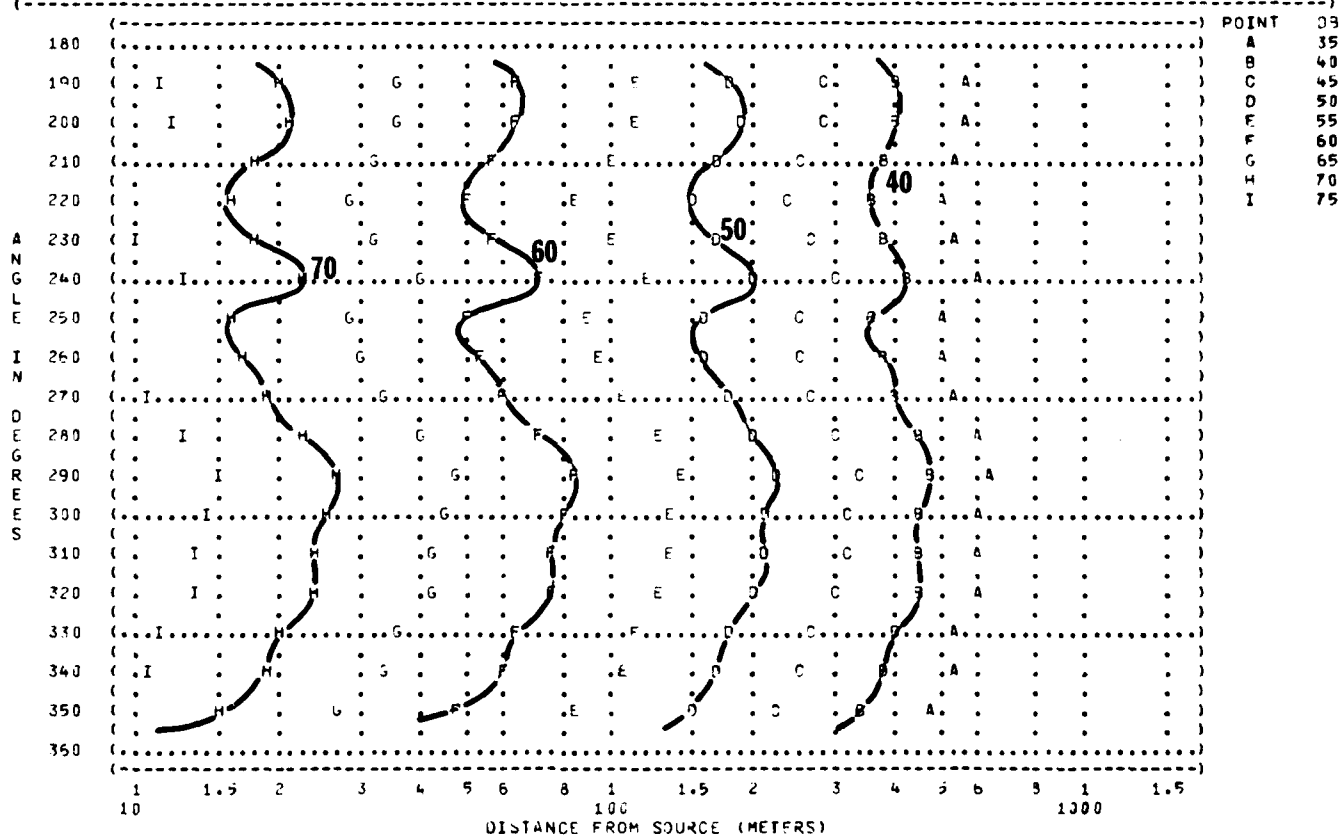


(FIGURE: SOUND PRESSURE LEVEL (SPL)
 (9 EQUAL LEVEL CONTOURS (dB)
 (125 HZ OCTAVE BAND

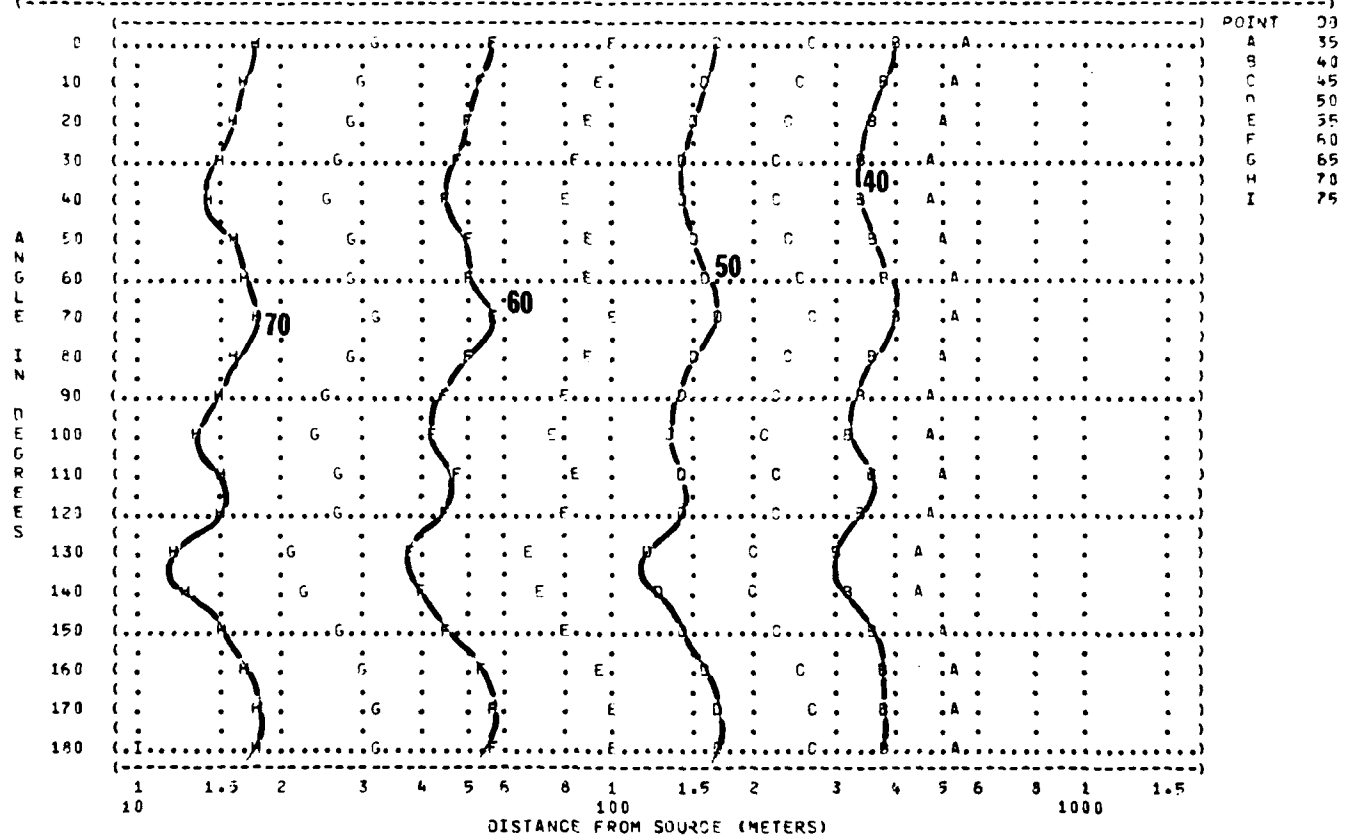
(IDENTIFICATION:)
 ()
 () OMEGA 1.4
 () TEST RA-000-002
 () RUN 02
 () 25 JAN 82
 () PAGE 18

(NOISE SOURCE/SUBJECT: (OPERATION:)
 (MC-1 HEATER, DUCT TYPE, (3400 RPM
 (PORTABLE ()
 (FAR FIELD NOISE LEVELS ()

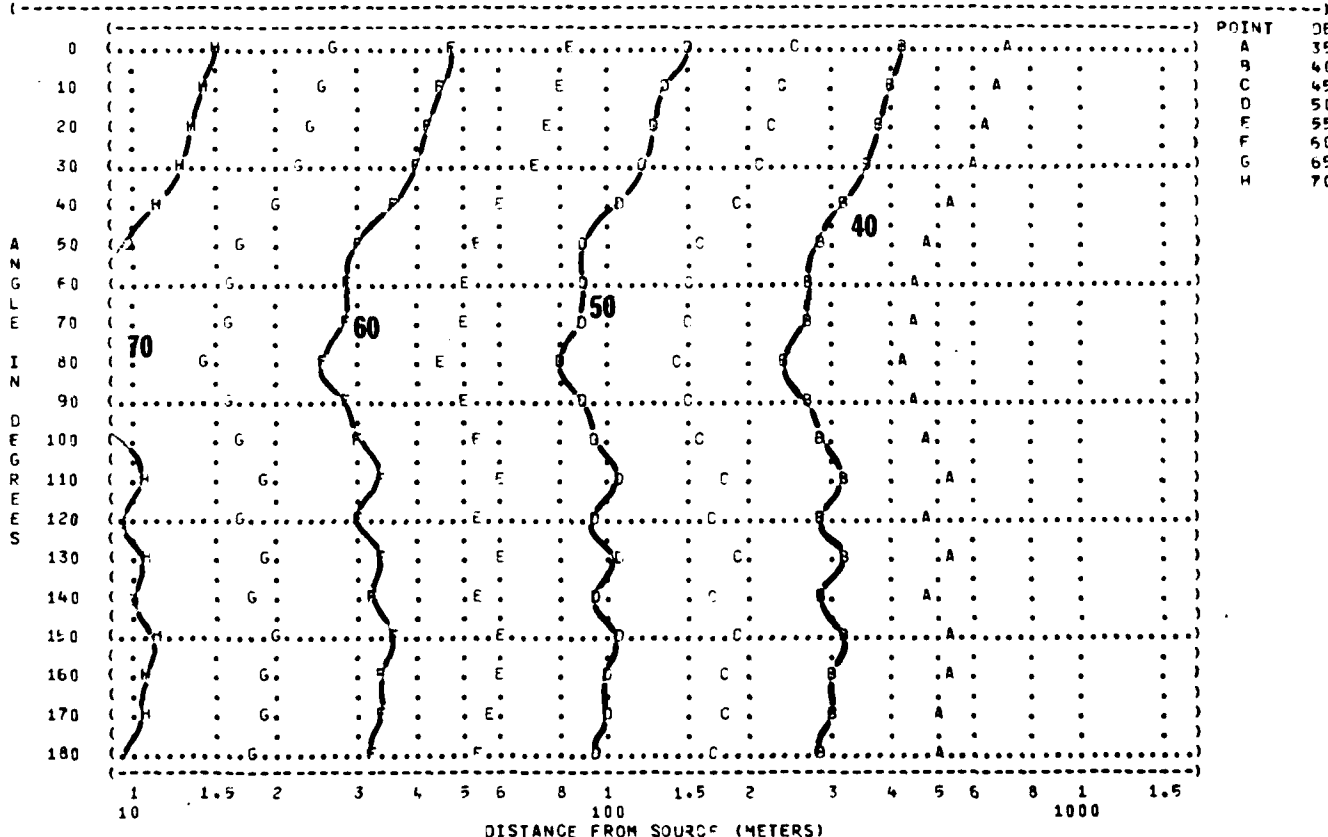
(METEOROLOGY:)
 (TEMP = 15 C
 (BAR PRESS = .760 MM HG
 (REL HUMID = 70 %



(FIGURE: SOUND PRESSURE LEVEL (SPL)) IDENTIFICATION:)
 (9 EQUAL LEVEL CONTOURS (dB)))
 (200 HZ OCTAVE BAND))
 (NOISE SOURCE/SUBJECT: (OPERATION:) METEOROLOGY:) TEST RA-000-002)
 (MC-1 HEATER, DUCT TYPE, (3600 RPM) TEMP = 15 C) RUN 01)
 (PORTABLE () BAR PRESS = 1.760 M HG) 25 JAN 82)
 (FAR FIELD NOISE LEVELS () REL HUMID = 70 %))
 () PAGE 19)



(FIGURE 9 SOUND PRESSURE LEVEL (SPL) EQUAL LEVEL CONTOURS (FB) 500 HZ OCTAVE BAND )			) IDENTIFICATION:)
(NOISE SOURCE/SUBJECT: )			) OMEGA 1.4)
(MC-1 HEATER, JUCT TYPE, )			) TEST BA-000-002)
(OPERATION: )			) RUN 01)
(3400 RPM)))
(PORTABLE )			) 25 JAN 82)
(FAR FIELD NOISE LEVELS)))
( )			) PAGE 20)



(FIGURE: SOUND PRESSURE LEVEL (SPL)			) IDENTIFICATION:)	
(9 EQUAL LEVEL CONTOURS (DB)))	
(500 HZ OCTAVE BAND			) OMEGA 1.4)	
(NOISE SOURCE/SUBJECT:) OPERATION:) METEOROLOGY:) TEST RA-000-002 )			) RUN 02)	
(MC-1 HEATER, DUCT TYPE,) 3400 RPM) TEMP = 15 C )			) 25 JAN 82)	
(PORTABLE)) BAR PRESS = .760 Hg)))	
(FAR FIELD NOISE LEVELS)) REL HUMID = 70 % )			) PAGE 20)	

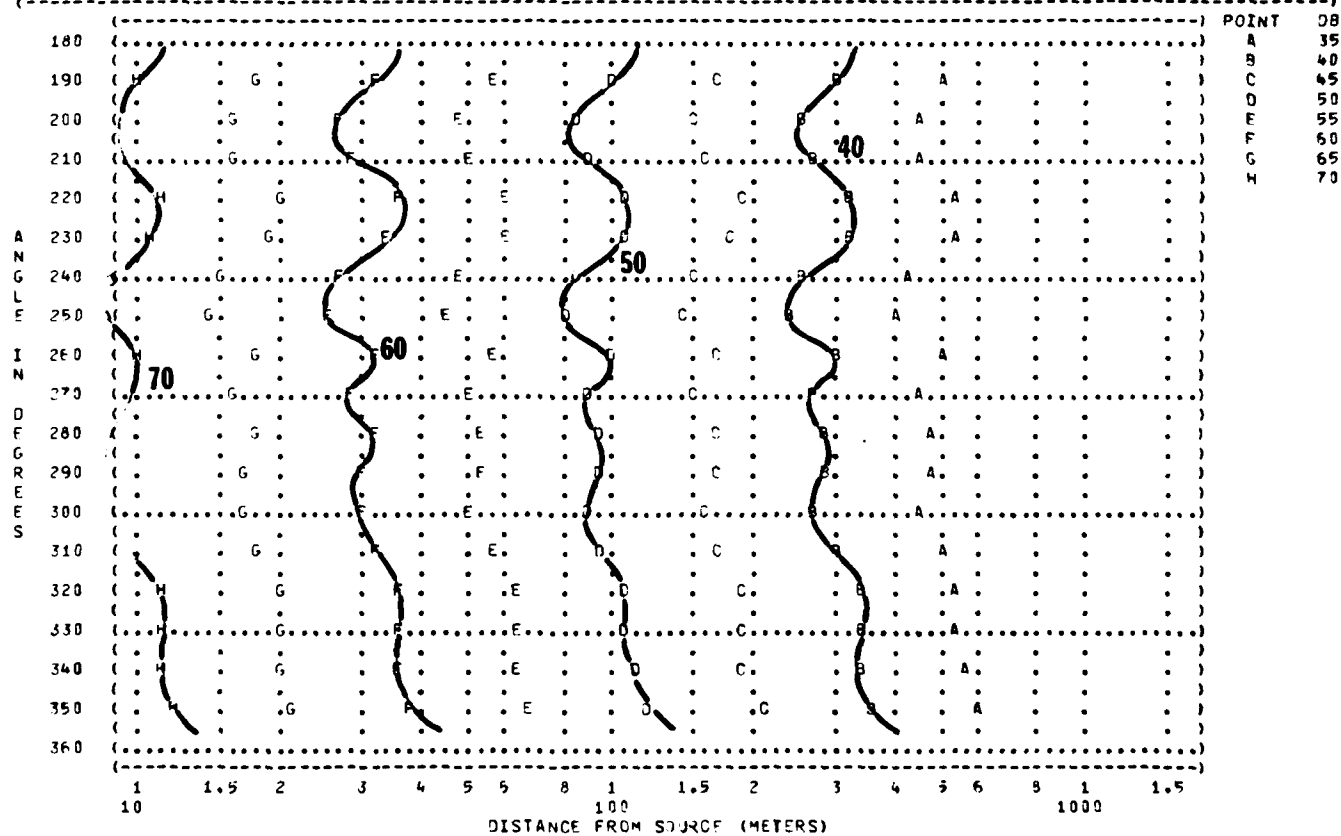
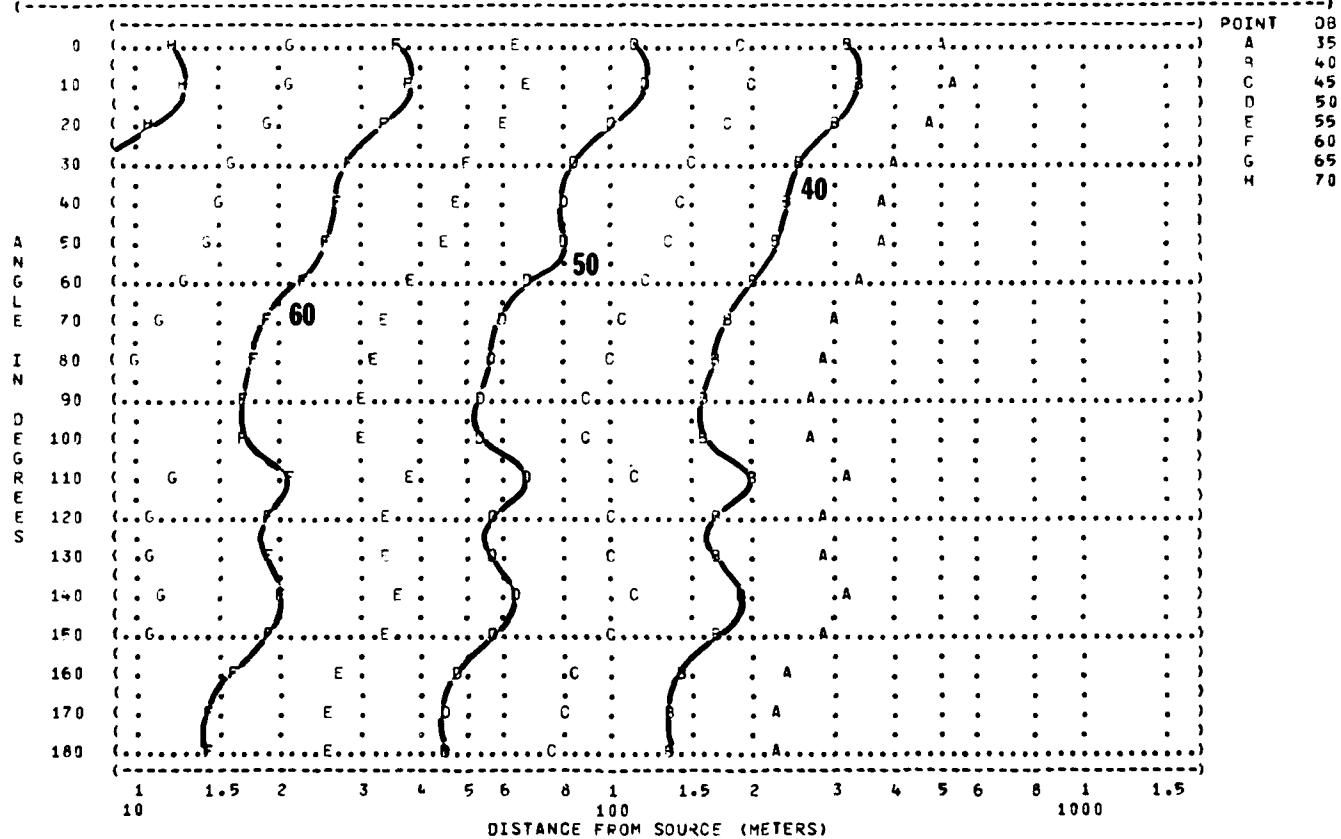
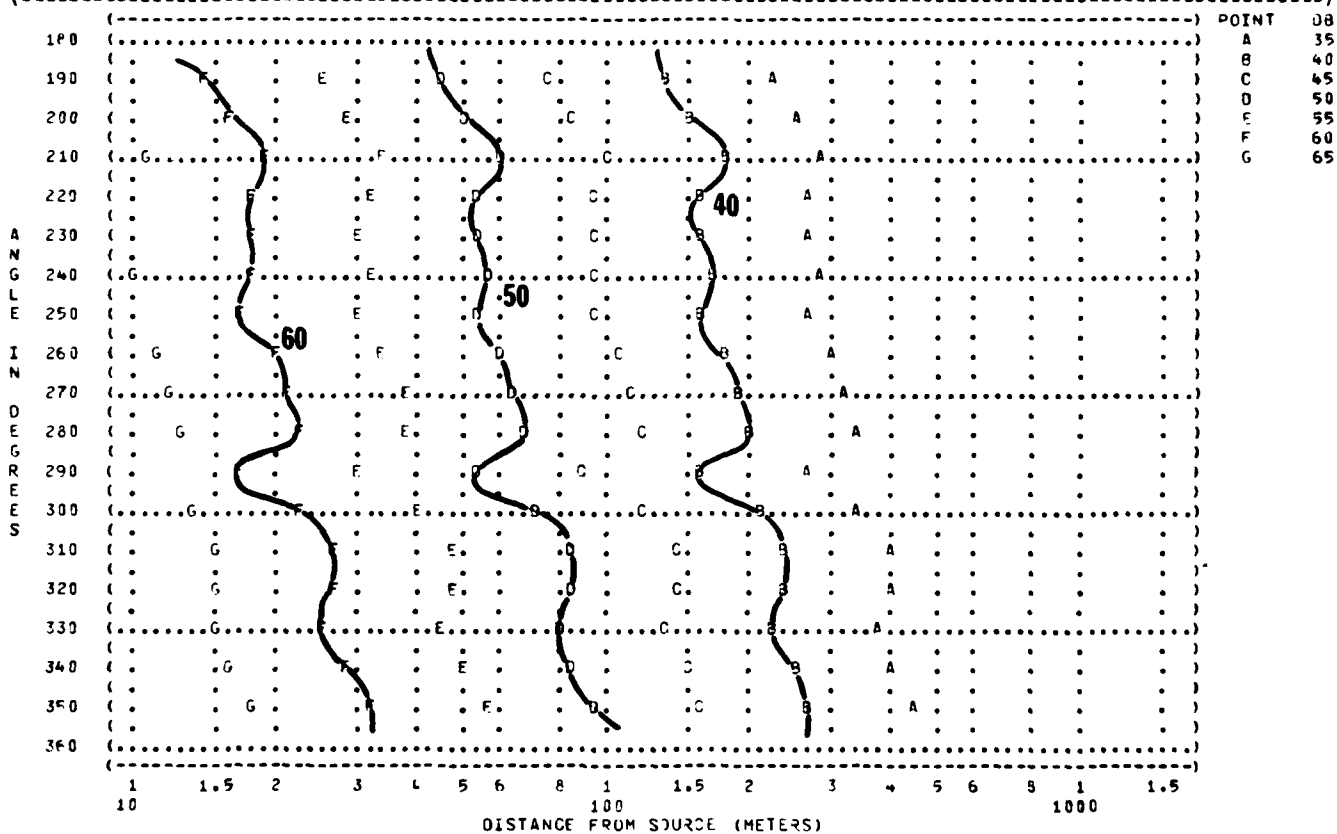


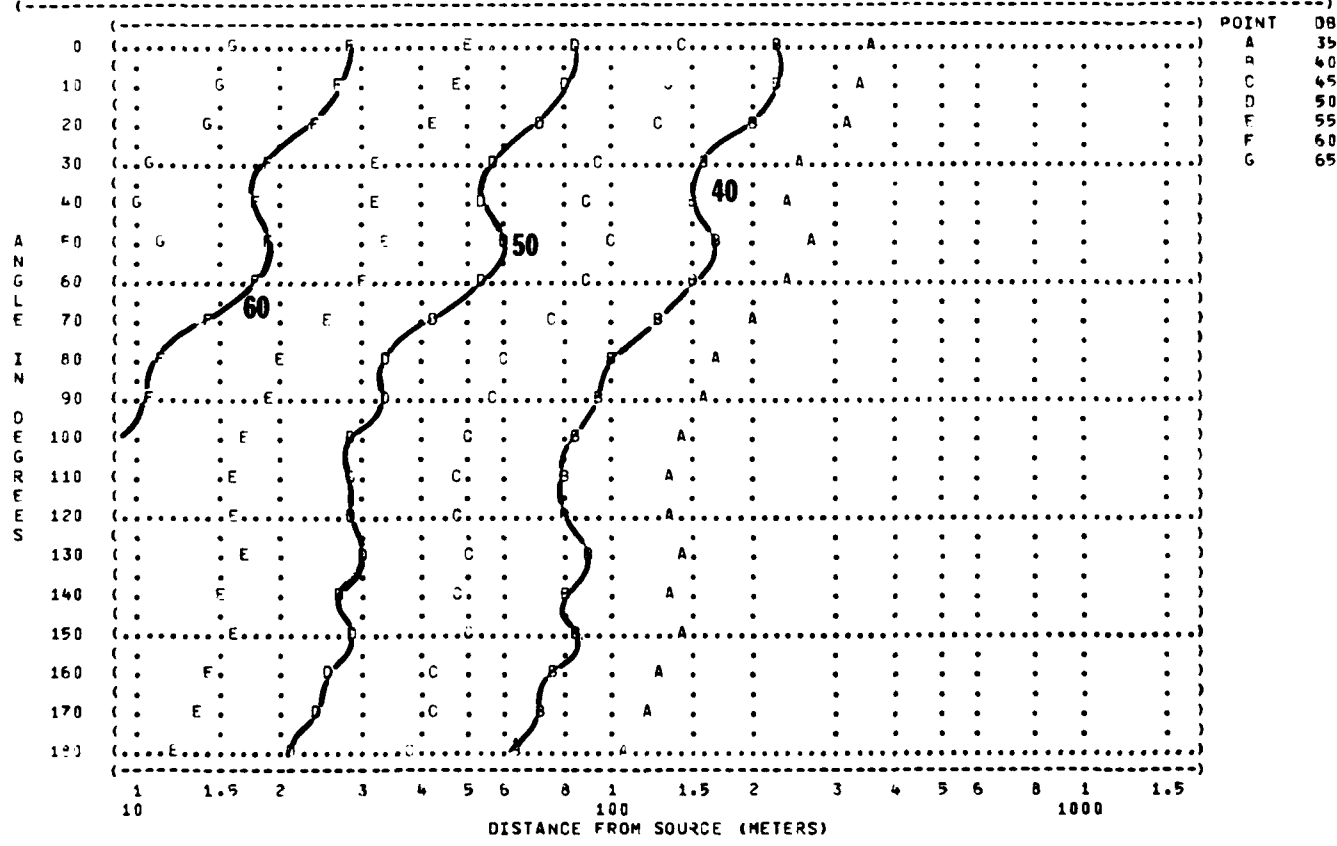
FIGURE 9 SOUND PRESSURE LEVEL (SPL) EQUAL LEVEL CONTOURS (FR) 1000 HZ OCTAVE BAND			IDENTIFICATION:
			OMEGA 1.4
			TEST BA-000-002
			RUN 01
NOISE SOURCE/SUBJECT:	OPERATION:	METEOROLOGY:	
MC-1 HEATER, DUCT TYPE,	3400 RPM	TEMP = 15 C	
PORTABLE		BAP PRESS = .700 M HG	25 JAN 82
FAR FIELD NOISE LEVELS		REL HUMID = 70 %	
			PAGE 21



(FIGURE: SOUND PRESSURE LEVEL (SPL) (9 EQUAL LEVEL CONTOURS (dB) (1000 HZ OCTAVE BAND) IDENTIFICATION:))) OMEGA 1.4)) TEST RA-000-002)) RUN 02)) 25 JAN 82)) PAGE 21)
(NOISE SOURCE/SUBJECT: (MC-1 HEATER, DUCT TYPE, (PORTABLE (FAR FIELD NOISE LEVELS	(OPERATION: (3400 RPM) METEOROLOGY:) TEMP = 15 C) BAR PRESS = .760 M Hg) REL HUMID = 70 %	



(FIGURE: SOUND PRESSURE LEVEL (SPL)			) IDENTIFICATION:	
(9 EQUAL LEVEL CONTOURS (DB))	
(2000 HZ OCTAVE BAND			) OMEGA 1.4	
(NOISE SOURCE/SUBJECT:			) TEST RA-000-002	
(MC-1 HEATER, JOST TYPE, (3400 RPM			) RUN 01	
(PORTABLE			) 25 JAN 52	
(FAR FIELD NOISE LEVELS			) REL HUMID = 70 %	
(			) PAGE 22	



(FIGURE: SOUND PRESSURE LEVEL (SPL)) IDENTIFICATION:)
 (9 EQUAL LEVEL CONTOURS (DB)))
 (2000 HZ OCTAVE BAND))
 (NOISE SOURCE/SUBJECT:) OPERATION:) METEOROLOGY:)
 (MC-1 HEATER, DUCT TYPE,) 3400 RPM) TEMP = 15 C)
 (PORTABLE)) BAR PRESS = .760 M Hg)
 (FAR FIELD NOISE LEVELS)) REL HUMID = 70 %)
 ()) PAGE 22)

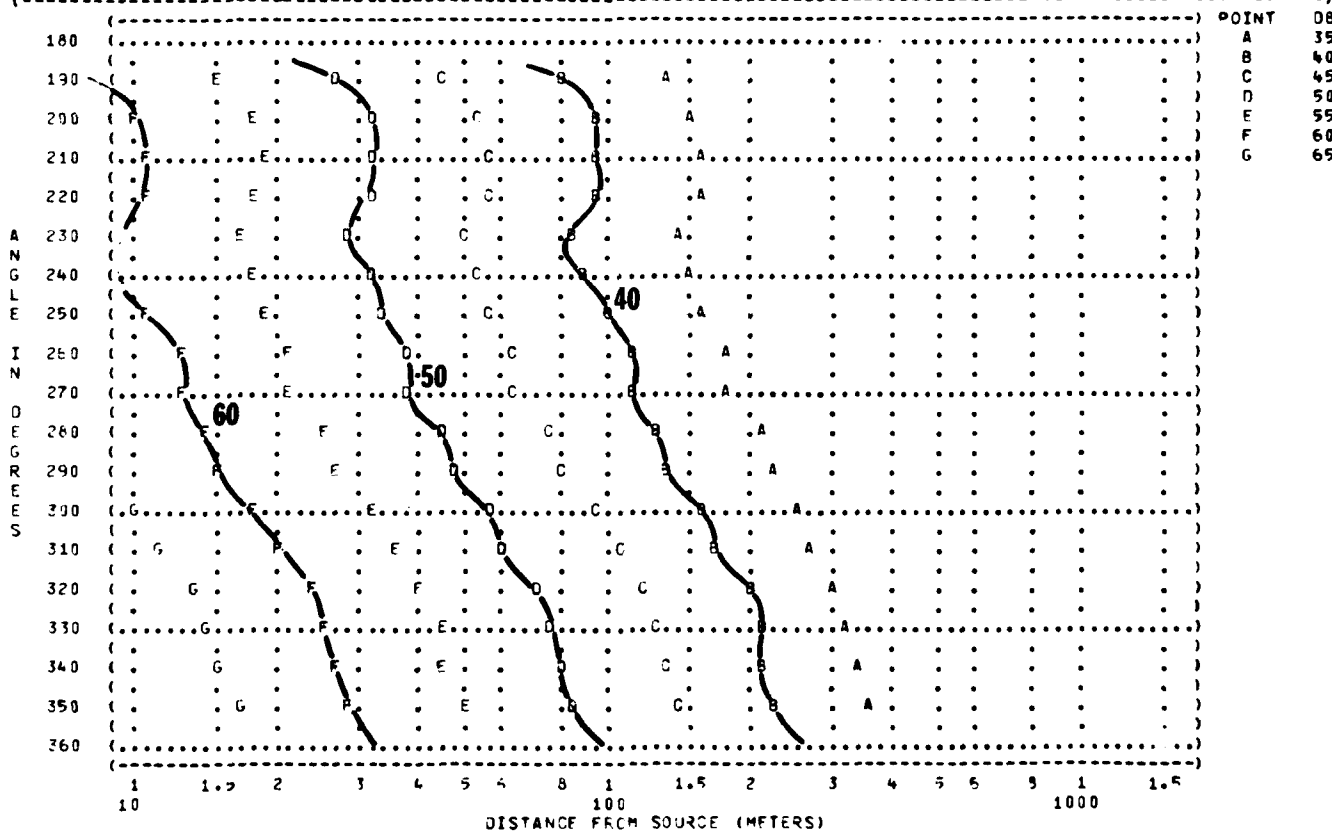
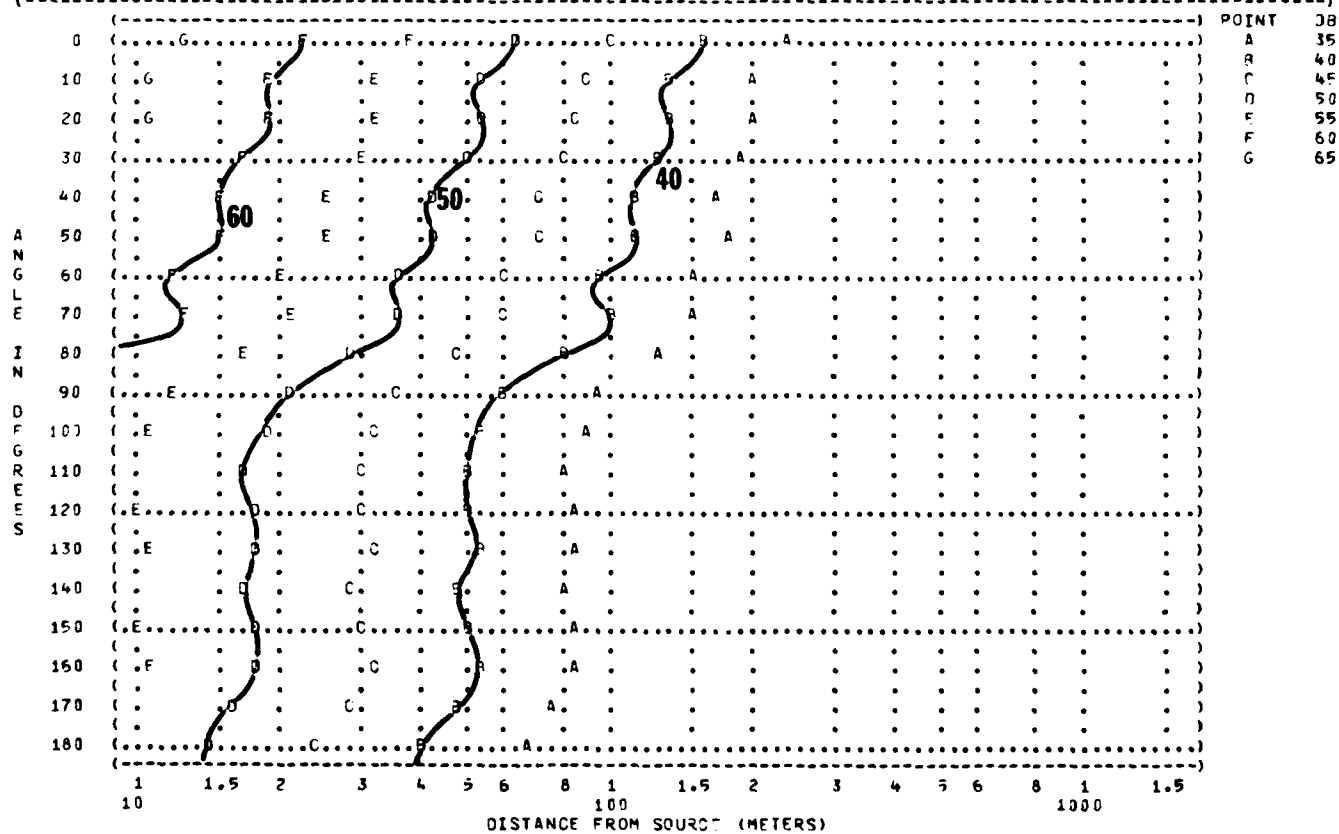
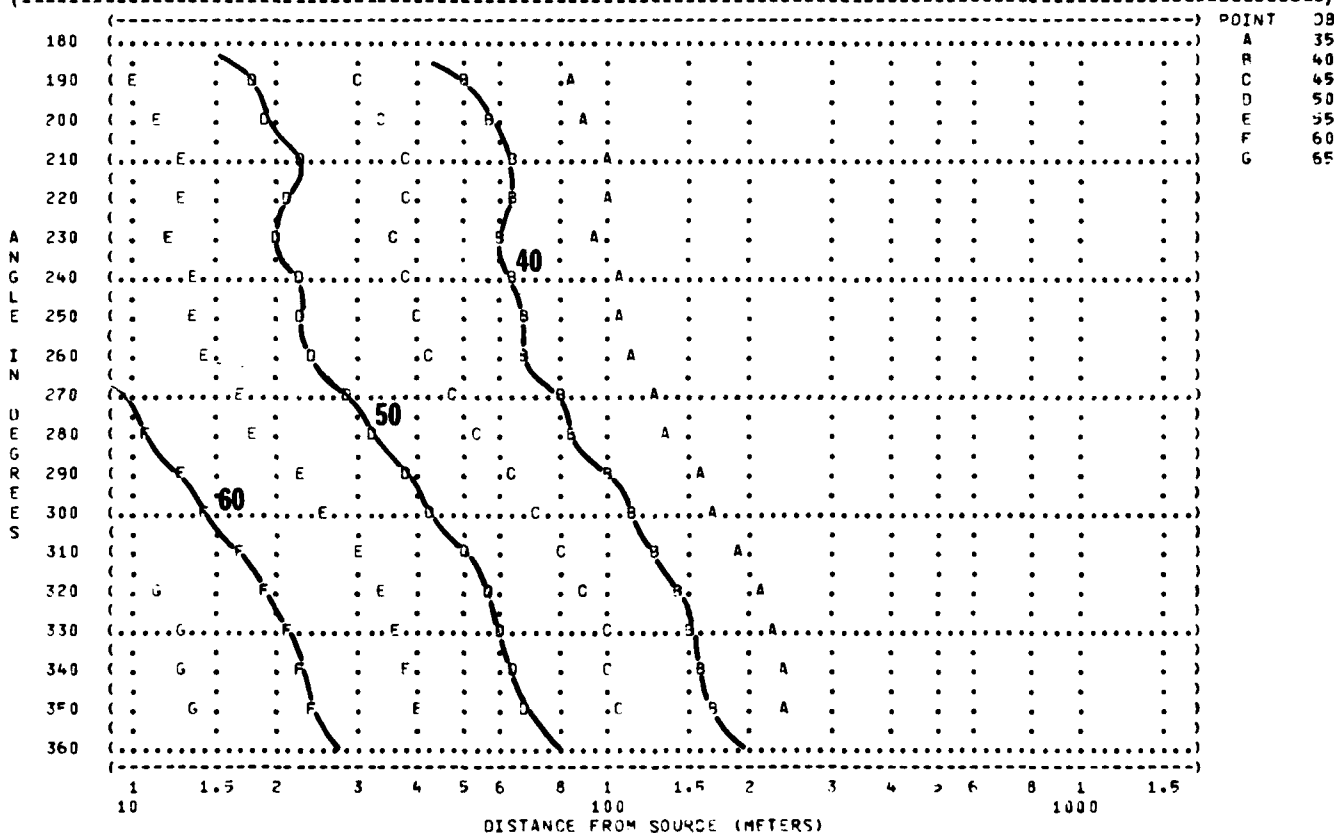


FIGURE 9 SOUND PRESSURE LEVEL (SPL) EQUAL LEVEL CONTOURS (LS) 4000 HZ OCTAVE BAND			IDENTIFICATION:
			OMEGA 1.4
			TEST RA-000-002
			RUN 01
			25 JAN 82
			PAGE 23
NOISE SOURCE/SUBJECT:	OPERATION:	METEOROLOGY:	
MC-1 HEATER, JUCT TYPE,	3400 RPM	TEMP = 15 C	
PORTABLE		BAR PRESS = .760 M HG	
FAR FIELD NOISE LEVELS		REL HUMID = 70 %	



((
(FIGURE: SOUND PRESSURE LEVEL (SPL)			) IDENTIFICATION:)		
(9 EQUAL LEVEL CONTOURS (DB)))		
(4000 HZ OCTAVE BAND			) OMEGA 1.4)		
(			) TEST RA-000-002)		
(NOISE SOURCE/SUBJECT:		(OPERATION:	) METEOROLOGY:		) RUN 02)
(MC-1 HEATER, DUCT TYPE,		(3400 RPM	) TEMP = 15 C))
(PORTABLE		(	) BAR PRESS = .760 MM HG		) 25 JAN 82)
(FAR FIELD NOISE LEVELS		(	) REL HUMID = 70 %))
(		(	)		) PAGE 23)
((

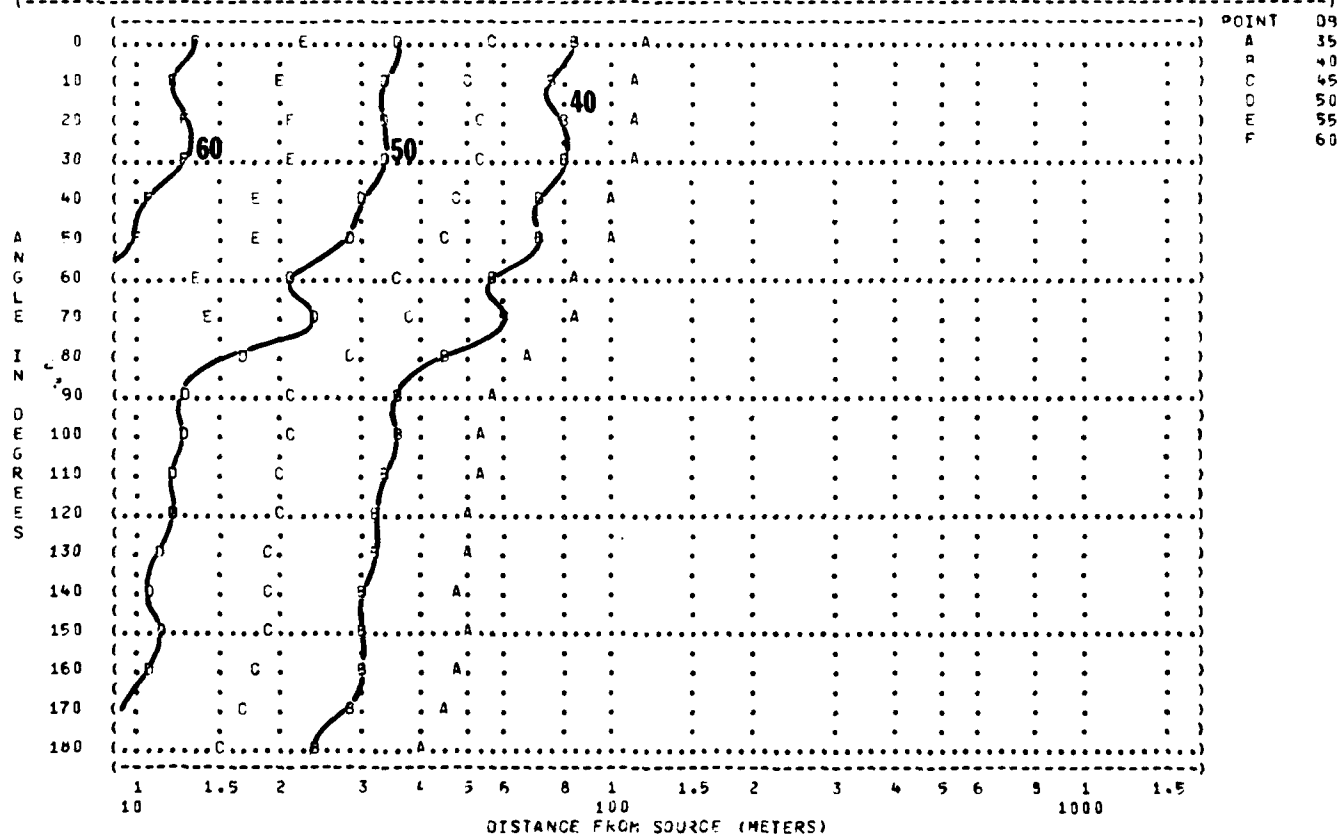


(FIGURE 1 SOUND PRESSURE LEVEL (SPL)
 (9 EQUAL LEVEL CONTOURS (dB)
 (6300 HZ OCTAVE BAND

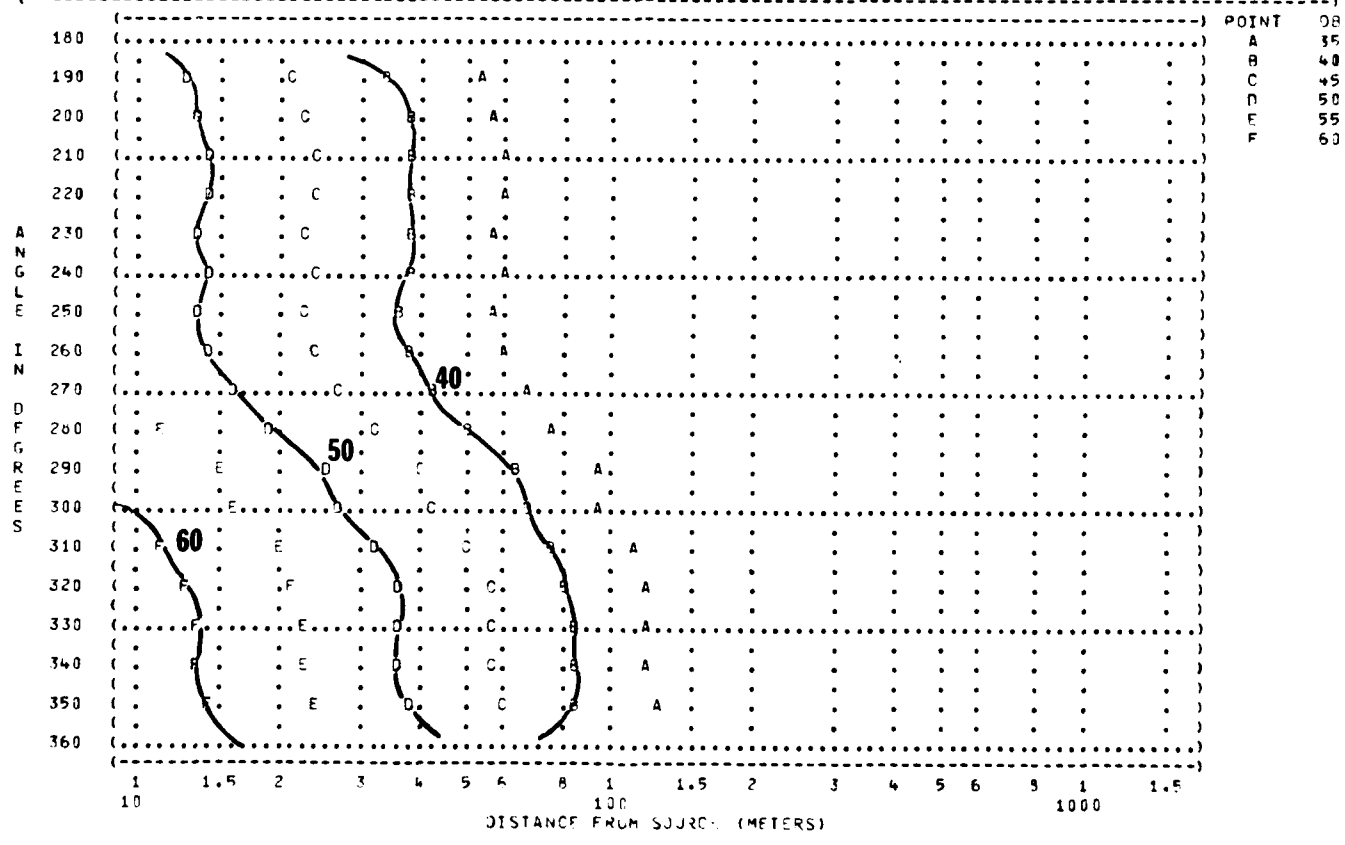
(IDENTIFICATION)
 () OMEGA 1.4)
 (TEST RA-000-002)
 (RUN 01)
 (25 JAN 82)
 (PAGE 24)

(NOISE SOURCE/SUBJECT: (OPERATIONS)
 (MC-1 HEATED DUCT TYPE, (3400 RPM)
 (PORTABLE ()
 (FAR FIELD NOISE LEVELS ()

(METEOROLOGY:)
 (TEMP = 15 C)
 (BAR PRESS = .760 MM HG)
 (REL HUMID = 70 %)



(FIGURE: SOUND PRESSURE LEVEL (SPL)			) IDENTIFICATION:)	
(9 EQUAL LEVEL CONTOURS (CR)))	
(8000 HZ OCTAVE BAND			) OMEGA 1.4)	
) NOISE SOURCE/SUBJECT: (OPERATION:) METEOROLOGY:) TEST RA-000-002 )			) RUN 02)	
(MC-1 HEATER, JUCT TYPE, (3400 RPM) TEMP = 15 C)	
(PORTABLE () BAR PRESS = .760 M HG)	
(FAR FIELD NOISE LEVELS () REL HUMID = 70 %)	
()) PAGE 24)	



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